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Harbor Comments

U.S. EPA

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Re: Comments on Behalf of EVRAZ Inc. NA on the Proposed Plan for the Portland Harbor Superfund Site

1 INTRODUCTION AND EXECUTIVE SUMMARY

EVRAZ Inc. NA (EVRAZ) submits these comments on the U.S. Environmental Protection Agency's (EPA's) Proposed Plan for the Portland Harbor Superfund Site, which was issued June 8, 2016 (USEPA 2016a). As a long-time Portland company that is fully committed to the City of Portland, to its environmental as well as to its economic health, EVRAZ considers the cleanup of the Portland Harbor to be one of the most important undertakings in the region's history. EPA's decision on the cleanup needs to be based firmly on sound science and well-thought-out public policy. It needs to be both protective and technically achievable. It needs to be structured so as to facilitate a timely cleanup by promoting settlements between potentially responsible parties to fund and implement the remedy. The record of decision (ROD) needs to be consistent with EPA's statutory and regulatory authority and thereby minimize the risk of legal challenge. EVRAZ has noted several areas where the Feasibility Study (FS) and Proposed Plan are not based on sound science, do not include goals that are not technically achievable, and are outside of EPA's statutory and regulatory authority. These issues need to be addressed before a ROD is issued or the ROD itself will be arbitrary and capricious and subject to prolonged litigation, which will only further delay implementation of a remedy. We appreciate that EPA has

sought broad input as part of its decision-making process, and we encourage EPA to carefully consider these comments as it refines its cleanup decision.

EVRAZ is committed to a cleanup of the Portland Harbor. As a member of the Lower Willamette Group (LWG), it has worked hand-in-hand with EPA over much of the past 15 years to fund and carry out the remedial investigation and feasibility study (RI/FS) for the Portland Harbor. In working with the LWG, EVRAZ was focused on carrying out the investigation, risk assessment, and analysis necessary to clearly support a sound cost-effective remedial action for Portland Harbor, which was summarized in the LWG's RI report, including its risk assessments, and in the draft FS provided by the LWG in October 2012. In the last 2 years, EPA has chosen to rewrite the RI and FS. These revised RI and FS documents, and EPA's Proposed Plan do not lead to a sound cleanup decision. The Proposed Plan has fundamental deficiencies both in terms of the information that was actually considered by EPA and the analysis of the information. Those deficiencies have led EPA to propose a fundamentally flawed remedy. Unless those deficiencies are corrected, any ROD issued following the currently Proposed Plan will be arbitrary and capricious and not in accordance with law.¹ Specifically:

- EPA's Proposed Plan does not appropriately consider risk, and proposes unsupported, unnecessary, and unachievable remediation goals (RGs). Just as one example, the Proposed Plan proposes a fish tissue goal of 0.25 parts per billion (or micrograms per kilogram; $\mu\text{g}/\text{kg}$) polychlorinated biphenyl (PCB), which is lower than the 23 $\mu\text{g}/\text{kg}$ PCB concentration EPA predicts based on its unrealistic background concentration of 9 $\mu\text{g}/\text{kg}$ in bedded sediment. We are not aware of any other EPA sediment site that sets even a PCB tissue target this low.
- The Proposed Plan does not accurately characterize natural recovery processes, present the uncertainties in its analyses, and determine how much risk reduction will actually be obtained by the remedial alternatives. This leads to selection of a Preferred Alternative that includes action beyond what is reasonable to make the site protective of human health and the environment. As just one example, the Proposed Plan deceives the public by saying that more dredging and capping will result in decreased risk from fish consumption. The difference between 5 and 9 fish meals per year identified for alternatives B and I, respectively, on EPA FS Figure 4.2-2 is immaterial. Fish advisories will continue to exist, and a person from the "vulnerable population"² is limited to 12 meals of resident fish per year as a consequence of high levels of mercury; this limitation is the recommendation of the Oregon Health Agency's (OHA's) fish advisory for the main stem of the Willamette River.

¹ 42 U.S.C. § 9613(j)(3)

² Vulnerable population includes children under age 6, women of childbearing age, and people with thyroid or immune system problems. Healthy individuals are advised to eat no more than 48 fish meals per month.
<https://public.health.oregon.gov/HealthyEnvironments/Recreation/FishConsumption/Pages/fishadvisories.aspx>

- The technology assignment flow charts presented in the Proposed Plan are overly prescriptive and do not provide sufficient flexibility to incorporate area-specific data or to refine technology assignment details during remedial design. Consequently, if the Proposed Plan flow charts were employed in their current form during remedial design, the overall effectiveness, long-term performance, and cost-effectiveness of the resulting remedy would be highly uncertain. The ROD needs to allow for decision making during remedial design based on additional studies and on area-specific conditions to ensure protectiveness and cost-effectiveness (USEPA 2005).³ Our comments include recommended modifications to the Proposed Plan flow charts to allow for more thorough consideration of site conditions and engineering constraints to determine appropriate technologies where sediment exceeds the remedial action levels (RALs) or is not expected to recover below RALs in a reasonable timeframe.
- The Proposed Plan underestimates the cost of the proposed cleanup. A number of firms with staff experienced in implementing Superfund cleanup projects have reviewed EPA's cost estimates and concluded that they are low by at least a factor of 1.5 (without any discounting) to a factor of 2 (including EPA's discount rate of 7%). This means that EPA's proposed cleanup could in fact exceed \$1.5 billion (Attachment 1).
- Most tellingly, it does not provide the critical cost-effectiveness analysis that is required by law. Further, because risk reduction is inappropriately quantified and cleanup costs are understated, that analysis cannot be performed with the information presented in the Proposed Plan.
- Finally, EPA's Proposed Plan totally fails to consider the very significant impacts on the community over the next 20 or more years. It does not account at all for the very significant economic impact of having local governments and businesses divert over a billion dollars into the cleanup effort, nor does it account for the direct impacts of the proposed remedy on activities on the river and on those who live and work near the river (NERA 2016).

Accordingly, EPA must revise the Proposed Plan to address these deficiencies and the specific deficiencies identified later in this letter so that the ROD is based on current data, sound science, and technical principles; and strictly conforms to EPA's decision-making guidance and authority under the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).⁴

³ "There is no presumptive remedy for any contaminated sediment site, regardless of the contaminant or level of risk" (USEPA 2005, p. 7-16). EPA stresses that "[i]t is important to remain flexible when evaluating sediment alternatives and when considering approaches that at first may not appear the most appropriate for a given environment" (USEPA 2005, p. 7-5).

⁴ 40 CFR 300.430 et seq.

EVRAZ supports implementation of a protective, cost-effective remedy as soon as possible. When the proper analysis is applied to all the information available, EVRAZ believes EPA will conclude that the appropriate remedial action will be very similar to Alternative B-i as presented in the LWG's March 30, 2012, FS. EVRAZ believes that this alternative will be quickly implementable, will result in a cleaner river much quicker than other remedies, and will be protective of human health and the environment.

2 BACKGROUND

As a company that is a part of Portland's working waterfront and manufacturing base, EVRAZ plays an important role in the region's economy. Its talented Portland workforce produces engineered steel for wind towers, energy transmission towers, armored vehicles and other armored applications, railroad car bodies, ships, barges, pipe, heavy equipment, and pressure vessels. The Portland mill makes steel for large infrastructure projects, oil and gas pipelines, and military applications. EVRAZ employs hundreds of skilled workers at its Portland mill, driving over \$50 million annually into the local community through employee wages and benefits, and even more through the money it spends with local businesses and through the taxes it pays.

EVRAZ has demonstrated its commitment to the Portland Harbor cleanup by being one of the few entities that has worked with EPA since 2000; these entities have collectively paid in excess of \$110 million to carry out the RI/FS. It has approached the harbor from day one in a collaborative, problem-solving role. To assist in that effort, EVRAZ has retained expert engineers and scientists who have years of experience working on sediment cleanup sites similar in complexity to the Portland Harbor, including the Lower Duwamish Waterway (supporting the RI/FS and pre-remedial design investigation and implementing Early Actions at Slip 4 and Terminal 117), East Waterway (Elliott Bay, Seattle, WA), Upper Columbia River, and Commencement Bay Superfund Sites in Washington; the Passaic River Superfund Site in New Jersey; the Big River Superfund Site in Missouri; and the Berry's Creek Superfund Site in New Jersey. In preparing these comments, EVRAZ has relied on those same experts in hopes of reaching the right solution for Portland Harbor.

Sections 3–9 provide technically detailed comments on EPA's Proposed Plan and its lack of compliance with scientific best practices or with EPA's own guidance. Before, however, diving into that level of detail, it is important to make four important general points about the context and implications of the decision EPA is about to make.

First, EPA's decision on a remedy for Portland Harbor cannot be just about ordering the maximum amount of dredging that EPA can order. The remedy decision should be the result of a balanced deliberative process, as required by the nine criteria in the NCP.⁵ EPA should certainly be focused on overall protection of human health and the environment

⁵ 40 CFR 300.430 (e)(9)(iii).

and compliance with applicable or relevant and appropriate requirements (ARARs), as required by the NCP, but it must also carefully consider the balancing factors as interpreted by EPA's own regulations and guidance which, as discussed below, we do not believe EPA has followed.


EPA needs to consider this site in the context of the Portland community, specifically the protection of community resources, the function and use of the working harbor, and the direct economic impact of the cleanup. EPA is poised to order a remedy that it states will cost \$800,000,000 and that, for reasons explained below, likely will cost double that. Requiring the State of Oregon, local governments, the Port, local utilities, and local businesses to implement that remedy will have staggering economic impacts on each of those entities. It will mean employees cannot be hired or retained, that capital investments needed to retain a position in the competitive market cannot be made, and that sorely needed operational and infrastructure efforts will need to be scaled back.

An economic analysis (NERA 2016) that evaluated both the benefits and costs of remediation work to the regional economy conservatively estimates that EPA's Preferred Alternative (Alternative I) will result in an additional average annual job loss of between 120 and 300 jobs and an average annual gross regional product loss of \$18 to \$44 million. It will also mean that the money spent attempting to achieve ultra-low contaminant concentrations will not be available to spend on the problems that mostly seriously impact the community. This proposed remedy will likely bankrupt local businesses, even businesses thought to be well established in the community. The proposed remedy itself will have at least immediate, and possibly long term, negative impacts on some of the very fish and wildlife it aims to protect. If EPA is going to order a remedy that has those consequences, it needs to make certain that the benefits it claims will be attained are accurately projected and clearly explained, so that EPA itself, as well as all of the affected parties, clearly understand what those benefits will be and why EPA is requiring these staggering economic tradeoffs to achieve them.

Indeed, EPA is empowered with broad authority and given great deference to make deeply impactful decisions that can have all of these consequences without pre-impact judicial review. This level of un-reviewable authority vested in the Executive branch comes with it a duty to the people and entities it intends to protect, a duty to limit the impact of its decision-making power in a balance that protects human health and the environment in a cost-effective manner so as not to have a negative effect on the economic health of the community. This is required under EPA's own NCP.⁶ EPA has not met the burden of scientific and technical diligence necessary to fulfil this duty.

The concept of what EPA "can" do is an interesting one in the context of the federal Superfund program. Unlike almost every other federal government decision, the

⁶ EPA must determine that the "overall effectiveness" of the remedy is proportional to the cost. 40 CFR 300.430 (f)(ii)(D).



Superfund law does not allow “pre-enforcement review” of remedy selections. Thus, there will be no immediate court challenges to EPA’s remedy selection. 42 U.S.C. § 9613(h). (There are many, including EVRAZ, that believe this amounts to a violation of their due process rights, and the U.S. Supreme Court has shown itself willing to look critically at agency actions supposedly exempt from such review. *Sackett v. EPA*, 556 US 502 (2012).) Despite the current unavailability of pre-enforcement review, if EPA does not select a remedy that is implementable, it will find that entities like EVRAZ that, as a matter of sound corporate management, require clarity and certainty in their funding decisions, will not be able to sign blanket “consent” orders to perform that remedy. EPA will then need to use its enforcement powers to compel performance of unilateral cleanup orders and, at that point, a court will need to decide whether EPA’s cleanup orders⁷ are lawful, or whether they are arbitrary and capricious and not in accordance with law. In fairness to EPA and to everyone who has a stake in the cleanup of Portland Harbor, EVRAZ carefully explains herein why it believes EPA’s Proposed Plan is arbitrary, capricious, and not in accordance with law so that EPA has the opportunity to correct those deficiencies before issuing the ROD it intends to enforce.

Second, EPA needs to focus its sediment remedy decision on the goals that can be realistically achieved through a sediment remedy (USEPA 2005) in an active, working harbor, or EPA needs to acknowledge that its goals are unachievable and include technical impracticability waivers for unachievable goals in the ROD. There are many efforts underway to improve the health of the Willamette River basin as a whole through watershed management programs, all the way from Oregon’s recent revisions of its water quality requirements to the many localized efforts at habitat improvement and stream protection. The issue for EPA to decide right now is what can and should be attained through a sediment cleanup in the 10-mile stretch of the Willamette River in Portland Harbor. This remedy cannot control the quality of the Willamette River water entering Portland Harbor from the 175 miles upstream, it cannot control the natural process by which upriver sediments will slowly move into the Harbor, and it cannot control the low but ubiquitous levels of contaminants present in the urban environment.

- One indication of that EPA’s decision is not focused on goals achievable through a sediment remedy is that EPA has proposed that the remedial action be designed to achieve 107 different Preliminary Remediation Goals (PRGs) for 64 different chemicals. Successful sediment cleanups, such as the Hudson and the Lower Fox River, had RGs for PCBs only (focusing on sediment, with targets in fish tissue and surface water). These cleanups focused on PCBs, which primarily drove the risk that can be addressed by a sediment remedy. There is much more to be gained by keeping the eye on achieving the most important reductions in risk rather than trying to address every input into a very complex river system.

⁷ Under this circumstance, the performing parties retain their right to make reimbursement claims against the US government. 42 USC § 9606(b)(2).

- Another example of this in the context of a specific PRG. The best science supports the conclusion that the “equilibrium” concentration of PCBs in sediment moving into Portland Harbor will be approximately 20 µg/kg (LWG 2014). This is also supported by long-term monitoring at the Zidell remedial action in the downtown reach of the Willamette River, which shows concentrations in this upstream area are approximately 20 µg/kg (MFA 2012). Yet, EPA’s Proposed Plan would direct a cleanup to achieve its PRG of 9 µg/kg, at the cost of hundreds of millions of dollars over what it would cost to achieve 20 µg/kg, even though those sediments would ultimately re-equilibrate to 20 µg/kg based solely on the movement of sediments into the harbor from upriver.

As discussed below, if EPA focuses instead on setting a narrow list of RGs that are directly related to what can be achieved through a Portland Harbor sediment remedy, it will do the most good in helping address the watershed as a whole.

Third, with respect to the agency personnel and contractors who worked to produce EPA’s FS and Proposed Plan, those documents have every appearance of being rushed and assembled without the necessary consideration and analysis. Specific deficiencies are noted in the following sections, but it is also important to note overall that these documents are simply not of the quality needed to commit to what is likely over a billion dollar effort. LWG submitted a draft FS to EPA in 2012 that was thorough; well documented so that each step in its analysis was understandable; and consistent with all best professional practices, EPA rules and guidance, and with what EPA Region 10 had directed LWG to do during the years over which the RI/FS was performed. LWG offered repeatedly to work with EPA in discussing and revising the contents of that document. Instead, EPA chose to discard large portions of data and analysis in the RI/FS, including much of the work that EPA Region 10 had specifically directed LWG to perform. EPA then issued an FS and a Proposed Plan that are not up to the standards established by EPA for the LWG’s draft FS or the standards established for other regional and national sites of similar size and complexity. Much of EPA’s analysis and conclusions are not transparent or supported by anything contained within those documents. Although EVRAZ’s experts have done the best they can to guess how EPA has come to conclusions it states, in many cases that cannot be done. The purpose of this public comment process is to provide input on the analysis that led EPA to make its remedial action recommendation. Unfortunately, because of the poor quality of EPA’s FS and Proposed Plan, that is not fully possible. Issuance of these documents in the condition in which they were released is itself arbitrary and capricious and not in accordance with law.

Finally, it is also important to clarify what EVRAZ is not saying. EVRAZ is not saying that cleanup is not required or should not be implemented as quickly as possible. EVRAZ fully believes that the appropriate cleanup goals could be met by an integrated approach that incorporates technology approaches discussed in EPA’s FS and Proposed Plan, but that:

- Uses a realistic and appropriate set of RGs that consider background, site equilibrium, and risk management
- Defines principal threat waste in Portland Harbor consistent with policy and practice
- Acknowledges current site conditions and models and considers natural recovery at the site
- Fully takes into account the reasonable timeframe for site recovery, which EPA has stated to be 30 years
- Thoughtfully and accurately analyzes the remedial alternatives with careful analysis of the protectiveness, compliance with ARARs, reduction of toxicity/mobility/volume, long-term and short-term effectiveness, implementability, and cost, as well as the environmental, community, and economic impacts of the different alternatives.

As noted above, EVRAZ believes the appropriate remedial action will be very similar to Alternative B-i presented in LWG's March 30, 2012 FS. Alternative B-i focuses on action in the areas with the most significant risk, considers natural river processes, and can be readily implemented in a practical timeframe with appropriate monitoring completed to demonstrate its effectiveness. In order to implement such a remedy, EPA needs to first fix all of the problems with the FS and Proposed Plan, issue a technically defensible ROD, and then update its data set, which EVRAZ believes can be achieved through pre-remedial design work. By focusing on remedial action in areas presenting the most significant risks, and re-developing EPA's current work into a scientifically and technically defensible, transparent decision document, EVRAZ believes that EPA will be successful in proposing a plan that will have real impact on protecting human health and the environment in Portland Harbor, minimize impacts to the Portland area economy, and, importantly, be implementable in the short term.

3 DEFICIENCIES IN THE SETTING OF SITE CLEANUP GOALS

3.1 Overview

EPA rules⁸ and guidance (USEPA 1988, 2005) establish a thorough, scientifically grounded process for setting site cleanup goals. It is the process followed at all Superfund sites, so there is extensive information on how this has been done throughout the country, and what has worked well. The sequential steps are as follows:

⁸ NCP at 40 CFR 300.430(e)(2)

1. Establish **remedial action objectives (RAOs)**, which are narrative descriptions of the risk reductions that should be achieved by the remedy, first as preliminary RAOs and then as final RAOs in the ROD.
2. Based on the risk assessments, determine what chemicals are primarily driving risk for the site and establish **risk-based threshold criteria (RBTCs)** for those chemicals for the pathways in which they are posing risk.
3. In the FS, establish **PRGs** by considering RBTCs, ARARs, background concentrations, and practical quantitation limits. Establish a range of **remedial action levels (RALs)** for areas of active remediation to delineate the footprints of the remedial alternatives.
4. In the ROD, select a subset of the PRGs as final **RGs**, which are focused on the chemicals that will be addressed in the cleanup that are driving the majority of risk.
5. In the ROD, select a set of **RALs** that delineate the preferred alternative such that, at the conclusion of the recovery timeframe of 30 years deemed by the EPA FS to be reasonable, the RGs will be met.⁹

In this instance, EPA did not follow its own guidance or best practices in any of these steps. The RAOs and associated PRGs are overreaching. Some are poorly supported with science and site data; some necessitate cleanup beyond previous Department of Environmental Quality (DEQ)/EPA agreed values; and some values are simply not achievable because they do not consider realistic background and equilibrium conditions, ongoing loads from the urban watershed, and upriver conditions. All of these factors should have been taken to account when applying appropriate risk management principles (USEPA 2005).

As currently structured, the remedial action objectives and goals would tie parties responsible for, and willing to cleanup, legacy contamination in Portland Harbor to long-term management of the Willamette River watershed extending well beyond the scope of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) cleanup and therefore beyond what EPA can legally require. Setting objectives and goals at these levels will necessitate legal action on the part of the potentially responsible parties (PRPs). The CERCLA cleanup of Portland Harbor needs to focus on chemicals driving risk and achievable RGs that can be attained through a sediment cleanup, and it is critical that the ROD make substantial changes to RAOs, PRGs, and RALs to do this. If EPA moves forward with a ROD using existing RAOs, PRGs, and RALs, without re-visiting them and following its own guidance in the establishment of technically and scientifically defensible goals and objectives, then EPA will be acting arbitrarily and capriciously in issuing its ROD.

⁹ EPA FS section 4.1.3.

3.2 List of RAOs Needs to be Shortened to RAOs 1, 2, 5, and 6.

As a member of the LWG, EVRAZ worked with EPA as it developed the preliminary RAOs that guided the first years of the RI/FS process, as set forth in the 2004 Programmatic Work Plan. In 2009, EPA diverged substantially from this preliminary agreement, and it diverged much further in its draft and final FS documents and Proposed Plan. EVRAZ stands behind the objections made by LWG at each of those steps.¹⁰ In summary, LWG has consistently requested that EPA develop RAOs consistent with these important points from EPA guidance, and urges EPA to make these changes before issuing the ROD:

1. RAOs should be consistent with the site conceptual site model (CSM). That means the RAOs address contaminated media (sediment, soil, or water), exposure pathways, and receptors that are part of the CSM.¹¹
2. No RAOs are required for exposure media, pathways, and receptors for which the risk assessments conclude there is no unacceptable risk.¹²
3. RAOs are only established for objectives that are achievable from the site cleanup, as distinguished from regional goals that require additional actions outside of the CERCLA action.¹³
4. RAOs and PRGs should be consistent with the methodology of the risk assessments and the tools established in the RI/FS to develop PRGs.¹⁴
5. ARARs follow from RAOs. PRGs are developed based on RAOs, and PRGs are established based on either risk assessment or ARARs. Any potential ARAR is carried forward as a PRG only if changes 1 through 4 above are true with respect to that chemical for the exposure pathway and then only if the potential ARAR under

¹⁰ In particular, EVRAZ incorporates by reference all LWG comments regarding RAOs as documented through that process in the following: 1) the LWG's June 2009 recommended Revised RAOs and Management Goals; 2) EPA's September 2009 Directive to the LWG on RAOs; 3) the LWG's October 2009 response to that directive; 4) the LWG's June 19, 2014 Comments on EPA's Revised FS Section 2 (particularly Attachment 1); and 5) the LWG's March 25, 2015 Comments on EPA's FS Revised Draft Section 2 Text, at pp. 10–12.

¹¹ Contaminated Sediment Remediation Guidance (USEPA 2005), §2.4.1 at 2-15: "RAOs are typically derived from the conceptual site model, and address the significant exposure pathways."

¹² Contaminated Sediment Remediation Guidance (USEPA 2005), §2.4.1 at 2-15: "RAOs address the *significant* exposure pathways. . ." and "[t]he development of RAOs should include a discussion of how they address *all the unacceptable human health and ecological risks* identified in the risk assessment." (Emphasis added.)

¹³ Contaminated Sediment Remediation Guidance (USEPA 2005), §2.4.1 at 2-15: "When developing RAOs, project managers should evaluate whether the RAO is achievable by remediation of the site or if it requires additional actions outside the control of the project manager. For example, complete biota recovery may depend on the cleanup of sources that are regulated under other authorities. The project manager may discuss these other actions in the ROD and explain how the site remediation is expected to contribute to meeting area-wide goals outside the scope of the site, such as goals related to watershed concerns, but RAOs should reflect objectives that are achievable from the site cleanup."

¹⁴ Contaminated Sediment Remediation Guidance (USEPA 2005), §2.4.1 at 2-16: "The development of the sediment RGs may involve a variety of different approaches that range from the simple application of a bioaccumulation factor from sediment to fish or more sophisticated food chain modeling. The method used and the level of complexity in the back calculation from fish to sediment should be consistent with the approaches used in the human health and ecological risk assessments."

consideration is either applicable or relevant and appropriate for that chemical for that exposure pathway under the particular circumstances of the site.¹⁵

EVRAZ has specific concerns that the following actions are particularly arbitrary and capricious and not in accordance with law and must be corrected to avoid legal challenge and we request revisions:

- Changing the overall RAO language to refer to “reducing COC concentrations” rather than, as originally stated, “reducing risk to acceptable levels.” The latter is a clear goal of CERCLA; the former is a goal only if a reduction in concentration is the best way to reduce risk. Language should be revised to focus on reducing risk to acceptable levels.
- Establishing an RAO 9 for Riverbanks. EPA violates the scope of the administrative order on consent (AOC; USEPA 2001) by including this RAO (“RI/FS work for uplands facilities is being or will be conducted pursuant to separate agreements or orders issued by DEQ or EPA and is not covered by this Order which is for the in-water portion of the Site”). Further, because it was not covered by the AOC, the RI did not collect data and the FS therefore had no basis for the analysis of alternatives with respect to riverbanks. See Comments of LWG on Proposed Plan at Section I.E, which EVRAZ incorporates fully herein. RAO 9 needs to be removed.
- Establishing RAOs 3 and 7 for surface water. EPA’s own explanation of these RAOs reveals their inappropriateness. In each case, these RAOs state that “reducing concentrations . . . of COCs in sediment will subsequently reduce surface water concentrations and reduce risk at the Site.” This statement ignores that the surface water in the site is a function of the quality of the surface water flowing into the site, which is something a Portland Harbor remedial action cannot fix. EPA’s guidance (USEPA 2005) says:

When developing RAOs, project managers should evaluate whether the RAO is achievable by remediation of the site or if it requires additional actions outside the control of the project manager. *** The project manager may discuss these other actions in the ROD and explain how the site remediation is expected to contribute to meeting area-wide goals outside the scope of the site, such as goals related to watershed concerns, but RAOs should reflect objectives that are achievable from the site cleanup.

RAOs 3 and 7 need to be removed.

¹⁵ 40 CFR 300.430(e)(2)(i) directs EPA to “establish remedial action objectives specifying contaminants and media of concern, potential exposure pathways and remediation goals. Initially, preliminary remediation goals are developed based on readily available information, such as chemical-specific ARARS or other reliable information. Preliminary remediation goals should be modified, as necessary, as more information becomes available during the RI/FS.”

- Establishing stand-alone groundwater RAOs 4 and 8. As stated, these RAOs appropriately are not about exposure to the groundwater itself (because that falls within the authority of ODEQ under its upland source control authority), but rather “such that levels are acceptable in sediment and surface water.” Given that qualification, separate RAOs for groundwater are not within the appropriate scope. RAOs 4 and 8 need to be removed.

Inclusion of these RAOs is not within the appropriate scope, is not supported by the RI/FS, and should not be included in the ROD. As LWG has previously commented, EPA could establish management goals for the media impacted by sediment but where sediment cleanup alone is not enough to achieve those goals (e.g., for fish tissue, acknowledging that an overall watershed effort beyond the reach of CERCLA itself will be needed to achieve those goals).

3.3 Preliminary Remediation Goals—Need to Apply Risk Management Principles to Develop a Narrower List of Remediation Goals in the Record of Decision.

Table 11 of the Proposed Plan sets forth EPA’s proposed PRGs, which should be revised and refined to a much smaller set of RGs in a revised FS and Proposed Plan, or in the ROD. As they are presented in Table 11 and used in RALs development and the alternatives evaluation, and particularly as they will be used to judge the success or not of the remedial action, EPA’s selection and application of PRGs are unsupported technically, are contrary to EPA guidance, and are arbitrary and capricious, as well as inconsistent with law.

Applicable regulation¹⁶ and guidance (USEPA 2005) requires that PRGs be developed to address site-specific risks as determined in the baseline risk assessments, taking into account details for site-specific exposures, uncertainties in the risk estimates, and implementation issues such as the technical feasibility of obtaining the PRGs. Risk management is considered in finalizing the PRGs.¹⁷ EPA’s Proposed Plan does not follow this guidance or best scientific practices. EVRAZ specifically adopts herein the comments made by the LWG with respect to PRGs, and adds the following:

1. EPA has too many PRGs—it needs to exercise risk management to shorten the list.

Fundamentally, there are too many PRGs; the list needs to be substantially narrowed when RGs are established in the ROD. EPA identifies an unreasonable number of PRGs without consideration for what is driving risk at the site and what is achievable through a sediment remediation. One of the first steps in going from the RI to the FS should include a narrowing and focusing of the assessment on those chemicals, receptors, and pathways driving the risk and remedy, i.e., a

¹⁶ NCP at 40 CFR 300.430(e)

¹⁷ EPA’s sediment guidance directs that cleanup objectives “should reflect objectives that are achievable from the site cleanup.” *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites*, OSWER 9355.0-85. December 2005. page 2-15.

selection of indicator chemicals or risk drivers. The U.S. Department of Energy (DOE) guidance on developing remedial goals indicates that PRGs should be developed for those chemicals that are the major contributors to unacceptable risks or hazards (DOE 1997). This has been the common practice at EPA-led CERCLA sites.

- 2. The PRG list is inconsistent with the conclusions of the risk assessments—EPA needs to eliminate PRGs for chemical/media pairs where the risks assessments indicate risk levels are acceptable or that they are not significantly driving site risks.**


Specifically, there should be sediment PRGs only for contaminants of concern (COCs) identified in the risk assessments as driving risk based on their presence in sediment. EPA primarily bases the remedy in the Proposed Plan on risk reduction from sediment actions for a set of focused COCs and for the identified risk-driving pathways associated with those COCs (primarily RAOs 1 and 2 for human health with some consideration of ecological exposure to sediment in RAOs 5 and 6). PRGs should be set only for those COCs and only in sediment.

- 3. EPA should not set fish tissue PRGs, although it may want a limited set of fish tissue monitoring levels in those few cases where there is a demonstrated correlation with sediment concentrations.**

Having only sediment PRGs would not mean that the post-construction performance monitoring could not be designed to show the protectiveness for the broader set of management goals suggested above. Specifically, the values for other media for which management goals have been set (e.g., as proposed above, fish tissue) should not be “PRGs” but rather performance-based monitoring levels.

Specifically:

- a. There should not be a fish tissue PRG or a Portland Harbor monitoring level for any chemical where EPA’s risk assessment concludes that there is no relationship between sediment concentrations and fish tissue concentrations. In those cases, because there is no expectation that the Portland Harbor sediment cleanup will reduce concentrations in fish tissue, it would violate a fundamental precept of CERCLA guidance (USEPA 2005) to establish a PRG by which the success of the remedy will be judged. Tables B1-5 through B1-9 of EPA’s FS reach the conclusion that, when attempting to establish a biota-sediment accumulation regression (BSAR), there is “no relationship” between fish or shellfish tissue concentrations in small home range biota and sediment concentrations for the following chemicals: arsenic, hexachlorobenzene, and mercury. They also conclude that there is “insufficient data” to reach any conclusion with respect to bis-2-ethylhexyl-phthalate (BEHP), which is a ubiquitous, urban-sourced contaminant. Therefore, EPA should not set either PRGs or even Portland Harbor monitoring levels for these chemicals.

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- b. EPA should not set a fish tissue PRG or Portland Harbor monitoring level if it does not have a basis to set a sediment PRG. For one class of chemicals, PDBEs, EPA proposes setting a fish tissue PRG but does not propose a sediment PRG. If it does not have a basis for setting a sediment goal, there can be no technical basis for assuming that the sediment remedy should or could achieve any particular fish tissue concentration.
 - c. EPA should not set fish tissue PRGs where sediment is not the controlling factor in fish tissue concentrations. Variation in sediment concentrations accounts for about 33% of the observed variation of DDX in resident fish tissue concentration at the Site (Integral 2016¹⁸). Therefore, other factors are responsible for the majority (67%) of the variation of concentration in resident fish tissue. If EPA establishes monitoring level for DDX, the ROD should be clear that other watershed improvements will be needed to reach that target.
 - d. EPA should not set fish tissue PRGs or Portland Harbor monitoring levels at levels that cannot be achieved at the expected sediment background or equilibrium concentrations. A sediment cleanup in Portland Harbor will not change background/equilibrium sediment concentrations entering the site from upstream (see additional discussion in Section 4.3). Therefore, tissue PRGs are not appropriate. Moreover, based on this analysis, the values EPA proposed as PRGs in the Proposed Plan are not appropriate even if they were to be designated as something less than PRGs. For example, the proposed 0.25 µg/kg fish tissue PCB PRG identified by EPA in Table 11 of the Proposed Plan is not achievable because it does not consider background or equilibrium conditions. Table J-2 in EPA's FS calculates an estimated fish tissue concentration for PCBs (expressed as a mean concentration) of 23 µg/kg based on EPA's projected residual background sediment concentration of 9 µg/kg. The equilibrium-based concentration of 20 µg/kg for PCBs would result in a fish tissue concentration closer to 50 µg/kg, which is similar to the range of upstream fish PCB concentrations.
 - e. Finally, any Portland Harbor fish tissue monitoring level needs to make sense from a practical public health perspective. The proposed fish tissue PRG of 0.25 µg/kg for PCBs makes no sense, even if it were to be applied only as a performance monitoring level. It is lower than some PCB levels measured in raisins by the FDA (2004; concentrations up to 10 µg/kg) and is lower than the concentrations in salmon raised in a fish hatchery (PCB concentrations range from 7 to 17 µg/kg in the Clackamas hatchery chinook tissue data¹⁹).

¹⁸ This memorandum is an attachment to LSS's comments on the Portland Harbor Proposed Plan, September 2016.

¹⁹ PCB data in hatchery fish tissue data was queried from the RI database (SCRACombo_Data_20110727.mdb)

4. EPA should not set surface water PRGs.

Setting surface water PRGs violates one of the fundamental precepts that no RAOs or PRGs should be established for exposure media, pathways, and receptors for which the risk assessments conclude there is no unacceptable risk.²⁰ The risk assessments concluded that there was no unacceptable risk for more than 20 of the chemicals for which EPA proposes surface water PRGs in Table 11 of the Proposed Plan:

- As shown in the LWG Comments on the Proposed Plan (Attachment 11), most of the chemicals for which EPA has set surface water PRGs were not identified as COCs in the baseline human health risk assessment (BHHRA).
- For other chemicals, like BEHP, zinc, and ethylbenzene, a low frequency of samples exceeded the threshold reference value used in the BERA, and the risk identified was very low with HQs below 2.
- As discussed below, the arsenic PRG is set based on a faulty ARARs analysis and should be 2.1 µg/l, which no surface water samples exceeded²¹ (e.g., in Appendix K to the Proposed Plan, EPA acknowledges that arsenic and other COCs don't exceed surface water criteria on a sitewide scale).

As with the fish tissue concentrations, although the sediment remedial action may also have some effect on surface water concentrations, no particular surface water concentration is dependent only on objectives that are achievable from the site cleanup, as distinguished from regional goals that require additional actions outside of the CERCLA action to address the upstream load.²²

Finally, as discussed below, to the extent EPA has set surface water PRGs on the grounds that they are ARARs, in many cases EPA has misidentified what the ARAR is by ignoring Oregon's duly promulgated, EPA-approved, water quality standards.


5. EPA should not set groundwater PRGs, including a groundwater manganese PRG.

There should not be either groundwater PRGs or groundwater targets. Looking closely at how EPA has set its proposed groundwater PRGs shows how scientifically inconsistent they are, for three reasons. First, as noted above, the two proposed groundwater RAOs are stated so as to achieve "levels that are acceptable in sediment and surface water." As explained above, there is no basis for surface water PRGs, let alone groundwater PRGs established in order to achieve surface water PRGs. EPA has already identified PRGs to be applied to sediment.

²⁰ NCP at 40 CFR 300.430(e)(2)(1).

²¹ It is not appropriate for EPA to compare surface water data on a scale smaller than sitewide against human health fish consumption criteria. Fish consumption risk is based on a long-term exposure to fish presumptively caught anywhere in the harbor.

²² Contaminated Sediment Remediation Guidance (USEPA 2005), §2.4.1 at 2-15.



Establishing PRGs to be applied to groundwater (which EPA describes as including “porewater”) (USEPA 2016a, p. 23) adds nothing since the RAO goal is clearly focused on achieving that concentration in the sediments themselves, not in the groundwater. Second, the great majority of proposed groundwater PRGs identified in Table 11 of the Proposed Plan are noted as being established by “ARARs.” As described below, that assertion is legally unsubstantiated. Third, setting PRGs based on surface water criteria ignores the very fundamental changes in contaminant concentrations (particularly of metals) that occurs as water crosses the groundwater/surface water interface due to geochemical changes. For example, high concentrations of metals in groundwater can drop quickly as that water enters the surface water column, due to oxygenation of water, loss of gasses like CO₂ (which raises the pH), and temperature changes. These changes can all cause precipitation of important constituents (such as iron and manganese oxides) and coprecipitation and sorption of trace, regulated metals. If the goal, as stated in the RAO, is to protect sediments and the surface water, it is the concentrations in those media that are important, and it can be very different from what would be measured in the groundwater/porewater.

With respect to the four proposed groundwater PRGs set based on maximum contaminant levels (MCLs) (1,1-DCE, 2,4-D, perchlorate, and 2,4,5-TP) and the one set based on a tapwater regional screening level (RSL), these are technically and legal inapplicable based on Oregon’s beneficial use designation of the Lower Willamette River, which EPA identifies as an ARAR. For the reasons described below, EPA has misapplied that ARAR because it has not considered the effect of drinking water pretreatment, which Oregon’s beneficial use designation says must be taken into account, or that the appropriate point of compliance is the (in this case very theoretical) point of distribution into a water system (rather than in the porewater).

The best example illustrating each of these problems is the proposed groundwater PRG for manganese of 430 µg/l. As a starting point, the surface water itself already meets this identified PRG (RETEC 2006, p. 5-3), so there appears to be no basis for setting a PRG in groundwater for the purpose of protecting the surface water. Second, as water moves from porewater to surface water, this is one of the chemicals subject to changes in concentration based on the geochemistry; specifically, the manganese becomes oxidized as it moves into the surface water, and it precipitates out of solution. Third, for RAO 4, which appears to be the basis for the proposed groundwater PRG, human use of surface water from the Willamette requires pretreatment. This pretreatment would include hardness adjustment/water softening. In addition to reducing the levels of dissolved calcium and magnesium (hardness), hardness adjustment would replace iron and manganese in solution with sodium. Therefore, manganese levels in groundwater/porewater in no way reflect the manganese concentrations that would be present in water used for potable purposes. More importantly, manganese is

one of the substances that is most clearly controlled by conventional water pretreatment, to well below the RSL level, just by filtration and chlorination. Fourth, the manganese tapwater RSL²³, even if it were otherwise appropriate, is derived from an incorrect and unsubstantiated, un-peer-reviewed, evaluation of the manganese EPA Integrated Risk Information System (IRIS) assessment and is not appropriate as a RAO. Even EPA admits that RSLs are not ARARs, because they are not validly promulgated, but are rather criteria that are “To Be Considered” (TBC).²⁴ In this case, it is a very weak TBC. EPA Guidance (USEPA 1991a, 2003) states that the selection of toxicity information for deriving risk-based screening levels should be based on an evaluation of the scientific quality and rigor of the underlying toxicological studies and the extent of peer review, with priority given to studies that are the most current, transparent, and peer-reviewed. Nonetheless, EPA proposes to set this as the PRG for manganese that will be applied to groundwater, ignoring both 1) that Oregon would look at the concentration in the water being used for drinking water, rather than point measurements in groundwater, and manganese concentrations would be addressed by standard pretreatment; and 2) the lack of peer scientific consensus on the toxicological conclusions on which EPA relies. The shortcomings of the manganese RSL are discussed further in Attachment 2.

6. EPA should not set “riverbank soil” PRGs.

For the same reasons discussed above that there should be no riverbank RAO, there should be no riverbank PRGs. (Thus, the column within Table 11 entitled “Riverbank Soil/Sediment” PRGs should apply to sediments only.) As explained above, the riverbank PRGs are not based on risk assessments or available data. They are set entirely equivalent to the PRGs for sediment, without considering any of the factors that change exposure assumptions (e.g., amount of time the riverbank is inundated such that exposure occurs, the potential for erosion [e.g., based on bank stability metrics], groundwater influences, etc.). In addition, in proposing riverbank PRGs, EPA appears to have just selected the lowest sediment PRG for a particular constituent, regardless of whether the exposure scenario or spatial scale is appropriate.

7. PRGs need to be adjusted to take into account appropriate analysis of both background and equilibrium.

As discussed below at Section 4, background and equilibrium conditions need to be considered in development of the sediment PRGs, as well as for any targets

²³ Table 2.1-1 of EPA June 2016 Feasibility Study. Note that this table incorrectly identifies this as an “EPA Regional Screening Level (RSL) for Groundwater.” In fact the current version of the document that EPA references is the “Regional Screening Level (RSL) Resident Tapwater Table” (May 2016 version). The prior November 2015 version to which EPA cites was called the “Regional Screening Level (RSL) Summary Table,” but it clearly indicated that the manganese RSL to which EPA refers was for “Tapwater.”

²⁴ Table 2.1-1 of EPA June 2016 Feasibility Study specifically identifies the RSL table from which this was taken as a “To Be Considered” criteria, not an ARAR.

developed for fish tissue and surface water. As described in that section, this means that the sediment PRG for PCBs should be set no lower than 20 µg/kg, based on its expected equilibrium concentration; the sediment PRG for DDX should be no lower than 5 µg/kg (LWG 2014); and an equilibrium-based PRG for dioxin/furan should be developed during remedial design. EVRAZ disagrees with the inclusion of surface water PRGs or targets; however, if they are established they need to take into account background concentration as explained in Section 4 below.²⁵

8. Acceptable risk levels for PRGs should be adjusted.

Based on EPA's own risk management guidance and the information presented in this comment letter, EPA should set the target risk between 1×10^{-5} and 1×10^{-4} . The following excerpts from EPA OSWER's 1991²⁶ guidance provide context for setting risks above the point of departure of 1×10^{-6} (USEPA 1991a):

- Where the cumulative carcinogenic site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 10^{-4} , and the non-carcinogenic hazard quotient is less than 1, action generally is not warranted unless there are adverse environmental impacts.
- The upper boundary of the risk range is not a discrete line at 1×10^{-4} , although EPA generally uses 1×10^{-4} in making risk management decisions. A specific risk estimate around 10^{-4} may be considered acceptable if justified based on site-specific conditions.

These risk management practices can be used in refining the list of chemicals that need PRGs as well as the numerical value of the PRGs as discussed further below. If an ARAR waiver is needed to do this, EPA should make that ARAR waiver decision in the ROD.

3.4 EPA Needs to Correct its "ARARs" Analysis and/or Waive Certain ARARs.

To the extent EPA has set PRGs based on the presumption that they are ARARs, EPA needs to 1) correct its misidentification of certain "ARARs," and/or 2) conduct the ARAR waiver analysis required by CERCLA section 121 prior to issuing its ROD and waive ARARs where appropriate in the ROD.

1. Many alleged "ARARs" identified by EPA are incorrect and need to be revised.

Table 11 of EPA's Proposed Plan identifies the basis for the majority of its PRGs as "ARARs." The majority of these designations ignore applicable law, ignore guidance, and, to the extent they are purportedly based on Oregon criteria, ignore

²⁵ Alternatively, EPA's ROD could establish a process by which background and equilibrium concentrations will be established, which will then be used to adjust RGs.

²⁶ *The Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*, OSWER Directive 9355.0-30

how the State of Oregon applies its criteria. For that reason, these ARAR determinations are arbitrary, capricious, and not in accordance with law.

a. Misidentification of surface water PRGs based on surface water “ARARs”

Table 11 of the Proposed Plan states that it relied on ARARs in selecting most of its surface water PRGs. These should be Oregon’s duly promulgated, EPA-approved, water quality standards:

If a State has promulgated a numerical [water quality standard, or “WQS”] that applies to the contaminant and the designated use of the surface water at a site, the WQS will generally be applicable or relevant and appropriate for determining cleanup levels, rather than [the National Recommended Water Quality Criterion or “NRWQC”]. A WQS represents a determination by the State, based on the [NRWQC], of the level of contaminant which is protective in that surface water body, a determination subject to EPA approval. (Emphasis added.) 53 F.R. 51394, 51442 (Dec. 21, 1988, explanation of revisions to the National Contingency Plan).

However, instead of giving due consideration to Oregon regulations, it appears EPA has made arbitrary choices in each case so as to choose any more stringent NRWQC, without giving the appropriate deference to the state-specific factors that led Oregon to regulate in a different way. There are many examples of this, including:

- **Surface Water PRG for arsenic:** In 1992, EPA adopted an NRWQC for arsenic of 0.018 µg/l. A NRWQC is something a state is required to take into account when it adopts its own water quality standards. Oregon did just that when it revised Oregon’s human health water quality criteria for arsenic on April 21, 2011, to 2.1 µg/L. Oregon set its standard higher than the NRWQC based on state-specific reasons, including its development of state-specific bio-concentration factors. EPA approved the criteria on October 17, 2011, making the revised criteria effective under the Clean Water Act. Thus, any discharge to the Willamette River meets the state water quality standard so long as it does not create a concentration in the river in excess of 2.1 µg/l. However, EPA totally ignored this Oregon standard in its Proposed Plan and has instead proposed a surface water PRG for arsenic of 0.018 µg/l, based on the NRWQC. This means that EPA will require any discharge to the Portland Harbor (e.g., groundwater, or discharges from remedial actions) to be cleaned up as if it had to meet a 0.018 µg/l concentration in the river, even though the State of Oregon has said that a concentration of 2.1 µg/l is fully protective (and EPA said the same thing from a water quality standpoint when it approved the Oregon standard). EPA

should not so arbitrarily ignore Oregon's protectiveness determination on this issue—that is, EPA should not set the stage to require very substantial expenditures so that water discharging to the river is over 100 times cleaner than the surface water standard itself. The standard that Oregon has determined through the EPA-approved water quality standard process is fully protective.

- **Other Surface Water PRGs:** Other proposed PRGs where EPA totally ignores EPA-approved Oregon water quality standards include those for aldrin (Oregon human health standard is 0.000005 µg/l); copper (Oregon chronic aquatic protection standard is 3.6 µg/l at hardness 25); cyanide (Oregon human health standard is 130 µg/L); DDE (Oregon human health standard is 0.000022 µg/l); pentachlorophenol (Oregon human health standard is 0.15 µg/l); benzo(a)anthracene (Oregon human health standard is 0.0013); benzo(b)fluoranthene (Oregon human health standard is 0.0013 µg/l); dibenzo(a,h)anthracene (Oregon human health standard is 0.0013 µg/l); indeno(1,2,3-c,d)pyrene (Oregon human health standard is 0.0013 µg/l), benzo(a)pyrene (Oregon human health standard is 0.0013 µg/l); 2,4-D (Oregon human health standard is 100 µg/l); trichloroethylene (Oregon human health standard is 1.4 µg/l) and vinyl chloride (Oregon human health standard is 0.023). Ignoring these Oregon standards will lead to the same result—EPA will have set the stage to require very substantial expenditures so that water discharging to the river must be treated to be cleaner than Oregon's fully protective surface water standards.

b. Misidentification of Groundwater PRGs based on surface water “ARARs”

As discussed above, EPA should eliminate all groundwater PRGs because they are not needed to support the RAOs. Further, the values listed in Table 11 as “Groundwater” PRGs are mostly human health (fish consumption based) water quality criteria *for surface water*, followed by aquatic protection water quality criteria *for surface water*, followed by MCLs *for drinking water*, and also including at least one *tapwater* RSL (for manganese, discussed in more detail above). None of these criteria is “applicable” to or “relevant and appropriate” to groundwater or to the porewater to which EPA's plan says they will be applied; thus, they are not ARARs for groundwater or porewater. For example, because fish do not access the porewater, it is nonsensical to apply a long-term fish consumption-based criteria to it.²⁷

²⁷ OAR 340-041-0033(3) (“The [human health] criteria *** are established to protect Oregonians from potential adverse health effects associated with *long-term exposure to toxic substances associated with consumption of fish, shellfish and water.*”); Oregon DEQ, *Reasonable Potential Analysis Process for Toxic Pollutants*, Feb 13, 2012, at 34 and 80 (for human health pollutant evaluations, the “receiving water body” is characterized by the geometric mean of a minimum of four 24-hour composite samples taken from the surface water during low-flow and high-flow conditions).

c. Misidentification of groundwater PRGs based on based on EPA's misinterpretation of Oregon's beneficial use designation for the Willamette River

Table 11 proposes the manganese groundwater PRG be set at the non-promulgated, non-binding RSL for tapwater. This designation is based on EPA choosing to ignore the portion of Oregon's beneficial use designation for the Willamette River that says the waterway should be protected for drinking water use "with adequate pretreatment" (OAR 340-041-0340, Table 340A). Oregon has previously explained exactly what this means (IDEQ and ODEQ 2004):

Waters designated as domestic water supply are required to meet general surface water quality standards for toxic materials and turbidity. These waters, while not required to meet drinking water standards in-stream, must be of sufficient quality that it is possible for them to meet drinking water standards with conventional treatment measures.

Oregon rules set forth the adequate pretreatment that is required, all focused on the quality of the water delivered after treatment to the user (OAR 333-061-0025 et seq.). EPA has chosen to ignore this aspect of Oregon's beneficial use designation and its own regulations and has apparently decided instead that any groundwater discharge to the river needs to meet this standard at any sampling point within that groundwater. EPA does not take into account either what the concentration would be in-stream or after conventional treatment, assuming the Lower Willamette River at Portland Harbor is ever used for drinking water (and there are no plans now to do that).²⁸

2. Under Oregon law, any possible ARAR needs to be adjusted to background.

To the extent EPA is adopting what it considers to be an Oregon-based ARAR, it can only do so after adjusting the ARAR value to account for what Oregon would determine to be natural background. OAR 340-122-0040 (1)(c).

3. EPA should evaluate the need for ARAR waivers and make those waiver decisions in the ROD, based on the evidence EPA has now.

Governing regulations and guidance require EPA to evaluate whether any criterion that it deems to be an ARAR should be waived for any of six reasons, two of which are most relevant here:

- a. "Compliance with such requirements is technically impracticable from an engineering perspective"

²⁸ If EPA does not eliminate these PRGs because they are not supported by Oregon's beneficial use designation, it should make the decision in the ROD to waive them under CERCLA section 121.

- b. “[the] State has not consistently applied (or demonstrated the intention to consistently apply) the standard, requirement, criteria, or limitation in similar circumstances at other remedial actions within the State.”²⁹

Although EPA’s guidance contemplates that ARAR waivers can be made either at the time of the ROD or later in a ROD amendment, both CERCLA and its guidance suggest that it should be done at the time of the ROD whenever possible. CERCLA section 121 strongly suggests that this determination should be made at the time of the ROD (“The President may select a remedial action meeting the requirements of paragraph (1) [protectiveness] that does not attain a level or standard of control at least equivalent to [an ARAR] if the President finds that . . .”).³⁰ EPA states in the Proposed Plan that its proposed Alternative I satisfies CERCLA’s requirement that it “comply with ARARs (*or justify waiver*)” (emphasis added). This suggests EPA has already done the evaluation as to whether an ARAR waiver is justified based on current evidence. However, elsewhere it is clear EPA has not done this: “[a]t this time, EPA has no information to justify waiving any of the identified ARARs at this Site” (USEPA 2016a).³¹

This amounts to EPA putting its head in the sand and is both wrong and foolhardy. It is wrong, because EPA has the information it needs now to make waiver decisions. What information is going to change that will inform these decisions 5 years from now that EPA does not already have? It is foolhardy because, during whatever time passes between the ROD and that inevitable waiver decision, tens millions of dollars of effort, if not hundreds of millions, will be wasted. EPA should make ARAR waiver decisions now with respect to surface water criteria and groundwater criteria (to the extent it believes they are compelled by ARARS, which EVRAZ disputes).

EPA should also make an ARAR waiver with respect to the risk levels to be achieved for the PCB sediment PRG. EPA states that it seeks to achieve a 1×10^{-6} risk level for PCBs in sediment, although it then caps that at its (incorrect) assertion that the background level for PCBs is 9 µg/kg. As discussed above, EPA has flexibility within its guidance to choose a cleanup that achieves cancer risk levels anywhere between 1×10^{-4} and 1×10^{-6} and non-cancer risk levels anywhere between 1 and 3 (USEPA 2016b). It does not consider these alternative risk levels, however, because it identifies Oregon’s cleanup statute as an ARAR compelling reduction of risks to 1×10^{-6} for cancer risks and to a Hazard Index of 1 for non-cancer risks.³² That statutory provision is an ARAR that can and should be waived, and EPA should

²⁹ 42 USC §9621(d)(4)(C) and (E).

³⁰ See also EPA OSWER, “Overview of ARARs: Focus on ARAR Waivers,” December 1989 (Publication 9234.2-03/FS); EPA OSWER, “Summary of Technical Impracticability Waivers at National Priorities List Sites,” August 2012 (OSWER Directive 9230.2-24).

³¹ Proposed Plan at 23; see also FS at 2.1.2

³² Proposed Plan at 23.

instead establish a technically achievable sediment PRG that still falls within its acceptable risk range at the time of the ROD, such as 20 µg/kg, which is both the sediment concentration associated with a 1×10^{-4} cancer risk and the equilibrium concentration calculated by LWG (LWG 2014). If EPA does not do that, it alone will be responsible for the waste of millions of dollars of effort chasing an unachievable sediment PRG.


3.5 EPA's Principal Threat Waste Determination is Unnecessary and Inconsistent with Guidance and Practice.

EVRAZ fully supports the comments on principal threat waste (PTW) provided by the LWG and incorporates them herein by reference. EPA's PTW approach leads to arbitrary and capricious remedial technology selections, inconsistent with both EPA guidance and practice as to the appropriate consideration of PTW. EPA's "highly toxic" PTW designation is unnecessary, legally inappropriate given the balanced evaluation of the NCP evaluation criteria, and is misleading to the public.

EPA guidance defines PTW as highly toxic or highly mobile source material that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur, such as drummed waste or pools of non-aqueous phase liquids (USEPA 1991b). The FS does not explain or justify why sediment at a concentration of 200 µg/kg PCBs is labeled "highly toxic." This description would suggest that such level of contamination poses an unusual, very dangerous risk. The truth is far from that. In fact, this concentration is below acceptable levels for residential exposures in upland soil—meaning that EPA concludes that there is no unacceptable risk if this concentration is present in the front yard of a family home. In fact, this concentration is also similar to levels measured in remote lakes impacted by atmospheric deposition. Cores collected from Lake Ozette (Olympic Peninsula, WA) contained total PCBs as high as 180 µg/kg in sediment from the mid-1960s depth horizon. The lake has shown recovery, with the 1980 horizon at 100 µg/kg (Yake 2001). Thus, the concentration is not "highly toxic" in any ordinary meaning of the words.

Further, EPA's handling of PTW does not match its practice at other recent large sediment sites. At the Lower Duwamish Waterway Superfund Site in EPA Region 10, concentrations of many contaminants are higher than at Portland Harbor; however, PTW was not identified at the Lower Duwamish Waterway site. In the ROD for the Lower Duwamish Waterway, higher concentrations were selected for RALs; intertidal sediment areas where recovery is expected the surface sediment RALs is 1,300 µg/kg in the top 45 cm and 3,900 µg/kg in subsurface sediment (USEPA 2014).³³ At the Fox River CERCLA Site (in Operable Unit 1), EPA's cleanup level for total PCBs is 1,000 µg/kg (USEPA and WDNR 2008).

³³ The RALs are 65 and 195 mg/kg oc, which convert to 1,300 and 3,900 µg/kg at 2% total organic carbon.



EPA provides no discussion or explanation of how material with sediment concentrations above the EPA-identified “highly toxic” thresholds or the presence of “globules or blebs” of non-aqueous phase liquid (NAPL) pose risk of contaminant migration. EPA has designated as “highly toxic PTW” large geographic areas based on its evaluation of “high toxicity” as compared to the human health fish consumption criteria (USEPA 2016a, p.14), which is an exposure pathway not typically used for PTW “highly toxic” designations. Given the uncertainties in the food web model (FWM) for deriving this concentration (e.g., surface water not representative of background) and the 2012 fish tissue results showing fish tissue risks are likely less than 10^{-3} , EPA’s use of a fish consumption criteria for its PTW designation is unsupported.

Moreover, EPA’s designation of sediment at 10^{-3} risk as highly toxic PTW is unnecessary to EPA’s alternatives evaluation and remedy selection for Portland Harbor. These considerations of sediment concentration in comparison to risk levels are all appropriately part of EPA’s evaluation of alternatives under the threshold and balancing criteria. Accordingly, in the ROD, EPA should eliminate the designation of any “highly toxic PTW” areas or, at the very least, not prejudice applicable technology assignments. Instead, it should simply carry the same information regarding concentration, mobility, and ability to be reliably contained into the alternatives evaluation under the NCP evaluation criteria, and make its remedial alternative decisions in that context. This outcome would be consistent with EPA’s treatment of the same issue at the Lower Duwamish Waterway Superfund Site.

4 AN ACCURATE DEPICTION OF SITE CONDITIONS IS NEEDED.

The EPA RI and FS present an oversimplified CSM that does not adequately describe site sources, environmental fate and transport processes, and exposure pathways and receptors in the complex and dynamic 10-mile-long Portland Harbor Superfund Site. A CSM needs to be developed that has appropriate detail, that considers baseline risks and spatial and temporal variability in the physical system and in chemical concentrations, and that incorporates current data. An updated CSM is needed as the basis for risk management, which includes developing a manageable list of achievable PRGs, appropriate RALs and remedial alternatives, crafting a technically supported comparative analysis, and identifying a preferred alternative. Guidance points out the importance of a well-developed CSM.

- ITRC guidance states the importance of conducting risk management decisions “on a site-specific basis...incorporat[ing] all available scientific information” because “[w]ithout a valid conceptual model of the site, it is not possible to define how a management option can successfully meet the risk-reduction goals and objectives” (ITRC 2014).

- EPA guidance states, “the development of an accurate conceptual site model, which identifies contaminant sources, transport mechanisms, exposure pathways, and receptors at various levels of the food chain” is “especially important...because the interrelationship of soil, surface and groundwater, sediment, and ecological and human receptors is often complex” (USEPA 2005).
- EPA’s and U.S. Army Corps of Engineers’ joint technical guidance on monitored natural recovery (MNR) explains that a “CSM is important for the sediment remedy selection process in general, but it is particularly critical for MNR remedies, as it comprises a framework that synthesizes all the available data to convey a thorough understanding of the site-specific natural processes and considerations that contribute to natural recovery. The CSM provides a basis for developing risk reduction strategies by differentiating between important and inconsequential routes of exposure.” (Magar et al. 2009)

The description of the site conditions in EPA’s RI and FS is not adequate to support the selection of a one billion dollar remedy. (According to EPA’s estimate, the Preferred Alternative will cost of one billion dollars to implement in non-discounted dollars).


EPA’s CSM is insufficient in many respects including background conditions, spatial and temporal variations in physical conditions and chemical distribution/concentration, the role of different sources, fate and transport considerations, and site uses. This section focuses on flaws in the CSM related to selected temporal and spatial variations in the data, calculation of background concentrations, and modeling of fate and transport. Additional comments on problems with EPA’s CSM provided by the LWG are incorporated herein by reference.

4.1 CSM Needs to Acknowledge Temporal Variation and Consider Current Conditions.

EPA’s RI and FS do not consider temporal changes in sediment concentration. Data collected over 14 years³⁴, from 1997 to 2010, is amalgamated and used to represent current site conditions. Risk is characterized by data collected over 10 years ago, mostly from 2002 to 2006. The data collection follows the major flood in the winter of 1996. The Site was likely still recovering from such an event when the data were collected, and the temporal variation must be considered. Given this recovery, consideration of current conditions is particularly important. EPA has ignored recent data³⁵ including: 1) the RM

³⁴ Most sediment data is from 1997 to 2010, but selected data sets are incorporated through 2014.

³⁵ The most recent PCB data were documented in a 2015 letter to and Jim Woolford, Office of Superfund Remediation and Technology and to Cami Grandinetti, EPA Region 10 from Schnitzer Steel, LSS, ExxonMobil, and BAE. “Natural Recovery of Sediments Affected by PCBs in Portland Harbor”. August 7, 2015. See also Kennedy/Jenks Consultants Memorandums dated March 6, 2013 and March 13, 2013 that summarize the data showing a decline in concentrations. Kennedy Jenks’ March 6 memo acknowledges it is comparing 2012 discrete



11E supplemental RI report (GSI 2014); 2) Kleinfelder (2015) sampling of PCBs in 2014 (98 surface sediment samples) sent to EPA in August 2015; 3) Germano Sediment Profile Imaging study (Germano 2014) sent to EPA in August 2015; 4) NewFields PAH data collected in 2014 and sent to EPA in March 2016 (NewFields 2015); and 5) smallmouth bass tissue data in 2011 and 2012 (GSI 2012 and Kennedy/Jenks 2013) (92 whole body tissue samples). These more recent data show that the EPA's CSM is flawed. Surface sediment concentrations have improved. Similarly, the 2012 fish tissue data show that concentrations of PCBs in fish tissue have declined since the data used in the HHRA were collected. The sitewide spatially weighted average concentration (SWAC) for PCBs has improved from the 92 µg/kg used in EPA's PCB RAL curve (FS Figure 3.4-1) to the 40 µg/kg calculated by the 2014 data set (LSS 2016).

EPA's selection of a remedy based on outdated data and without consideration of temporal variability is premature, as well as, arbitrary. EVRAZ requests that EPA collect and consider sufficient current data to ensure that the remedy for Portland Harbor is informed by and will address the current risk in the river.

4.2 CSM Needs to Acknowledge Spatial Variability in Portland Harbor.

EPA's CSM does not acknowledge the spatial complexity in Portland Harbor. It needs to take into account the various physical, chemical, and biological properties in evaluating appropriate RGs, RALs, and remedial alternatives. As discussed below, defining background-based PRGs using upstream sediment samples that are coarser and contain a lower organic carbon content than Site sediment, and excluding samples from depositional areas is not appropriate for the Site.

This is particularly apparent in the reach of the river downstream of the Multnomah Channel, and in the sediment decision unit (SDU 2E) offshore of EVRAZ's Rivergate property. River dynamics are unique in this area. The Multnomah Channel takes a portion of the Willamette River's flow where the river widens. This decreases flow rates, causing suspended sediment to deposit. This is particularly important during higher stages of the Columbia River which restrict discharge from the Willamette River, causing more water to flow through the Multnomah Channel. The EVRAZ Rivergate facility is located on the inside bend in this reach of the Willamette River. Deposition rates are high, and the sediment grain size is generally finer and higher in organic carbon than the rest of the site. PCB concentrations even at background levels tend to be higher in finer-grained sediment, and this needs to be considered in remedy selection. Organic carbon correction should be retained as an option for evaluating sediment data and consideration should be given to analyses of bioavailability and biodegradation at the Site. In addition, any technology flow

samples to earlier composite samples and bases its comparison on means, maximum, and minimum detected concentrations.

chart used by EPA needs to have flexibility to consider the spatial differences in the river characteristics when assigning remedial technologies.

The dynamics of surface sediment chemistry have a direct effect on the calculation of RALs from PRGs. When sediment surface chemistry is temporally dynamic, the RAL will also be time-dependent. Because the RALs were developed well before any cleanup action will be constructed, the surface chemistry at the time of remedy implementation should be used to establish an appropriate RAL that would lead to achievement of appropriate PRGs. Yet, EPA's FS devotes only one paragraph and one figure to the discussion of sediment recovery.

4.3 Realistic Background Conditions Need to be Defined.

EVRAZ requests that EPA use achievable sediment background/equilibrium and surface water background values to set PRGs and to evaluate remedial alternatives. Accurate background fish tissue concentrations should also be considered in evaluating alternatives. Site closure cannot be achieved when background-based RGs are not representative or achievable. Potential performing parties are not going to sign consent decrees to perform an ill-defined remedial action that, based on reasonable scientific and engineering assessment, is not likely to achieve site goals and therefore will not provide a reasonable endpoint for site closure. If EPA moves ahead with a ROD, then a background study for sediment, surface water, and tissue should be defined during the pre-design phase. The results of this evaluation should be used to update PRGs, RALs, and dredge/cap footprints. For chemicals with likely ongoing inputs from upland sources within and upriver of the Site at concentrations that exceed background, equilibrium values should be used (LWG 2014). Consideration of a technical impracticability waiver if the EPA-identified background conditions cannot be achieved should be added to the ROD.

The FS (Section 2.2.2.4) states that only sediment background concentrations were estimated and that background concentrations for other media could not be calculated due to insufficient data. As discussed in Section 3.2, EVRAZ does not believe PRGs should be established for surface water and tissue. Nevertheless, background conditions of these media need to be considered in the site CSM, risk calculations, and in any definition of target performance monitoring levels. The first and second drafts of the LWG's RI presented surface water background, and EPA's comments on those drafts gave no indication that data was insufficient to estimate background surface water concentrations. Surface water background conditions affect fish tissue; therefore, fish tissue background also needs to be considered when evaluating targets.

1. PRGs based on sediment background need to be revisited, and equilibrium conditions need to be considered.

Technical issues related to the EPA estimates of background values are discussed in the LWG August 2014 dispute on EPA's approach to defining background and in

the LWG comment letter on the Proposed Plan. Those points are incorporated herein by reference. EPA's assertion in the FS that Portland Harbor bedded sediment will recover its estimated background concentration of 9 µg/kg total PCB in a 30-year timeframe is not supported by an analysis in the FS and is not defensible.

Of particular concern to EVRAZ regarding EPA's calculation of total PCB background is that some of the samples identified as outliers by EPA are from finer-grained depositional areas with higher organic carbon. They are more representative of site background than those retained for the background data set. Sediment near EVRAZ Rivergate (SDU 2E) is finer grained and has a higher organic carbon content than the background sediment samples considered representative by EPA. Given that chemicals like PCB sorb more strongly to fine, organic carbon-rich sediments, the background sediments are not representative of the SDU 2E sediments, and the low PCB concentration calculated by EPA (9 µg/kg PCBs) will not be achievable in SDU 2E.

The Washington Department of Ecology (Ecology 2011) measured PCBs, among other contaminants, in surface sediment of lakes characterized as being minimally impacted by human activities. PCB concentrations as high as 8 µg/kg were found (Williams Lake, Spokane County). Thus, EPA asserts that sediment in Portland Harbor, an industrial harbor with a highly urbanized watershed, can recover to PCB levels (9 µg/kg) similar to a lake with minimal human impact (8 µg/kg).

The error in measurement limits often impedes the ability to achieve background-based PRGs, especially given the limitations of the small background dataset used for the Site. EPA should recognize that background cannot be defined as a bright line, but rather should be recognized to encompass a range of concentrations. We continue to urge EPA to express background sediment concentrations as ranges (e.g., 14 to 60 µg/kg for the full data set for PCBs³⁶) and fully consider equilibrium (e.g., calculated to be a median of 20 µg/kg PCBs and in the range of 7 to 35 µg/kg using empirical lines of evidence) (LWG 2014).

Finally, the risks due to background were not appropriately accounted for in the assessment of risk reduction. In fact, several of EPA's calculated post-construction sediment concentrations are below background levels and the estimate of equilibrium concentrations, which is not feasible (Table 4-1³⁷). Background



³⁶As recently as April 2015, EPA endorsed the concept of equilibrium as a measure of the most a sediment remedy can accomplish and committed to perform an equilibrium evaluation in Section 4 of the FS. The most appropriate means to evaluate whether RAOs or PRGs are achievable by any of the alternatives being developed in Section 3 of the FS is to conduct the detailed evaluation in Section 4 of the FS using the first seven NCP criteria. This information will be considered in developing the final remediation goals/cleanup levels. *EPA Response to LWG's March 25, 2015 Comments on the Portland Harbor FS Section 2*. April 10, 2015. page 2.

³⁷ This has occurred because EPA uses a zero replacement value to simulate the effects of remediation on the post-construction sediment condition.

conditions should be treated as a “boundary condition” and risk reduction below background cannot be achieved; thus PRGs should be set at levels that are achievable through a risk management step that considers background conditions.

Table 4-1. SDU-Specific SWACs vs. Background and Equilibrium for PCBs

	Alternative						
	A	B	D	E	F	G	I
NoSDU	30.53	30.38	30.09	29.74	23.74	18.73	30.06
RM2E	217.4	64.89	46.15	32.49	19.14	14.73	32.49
RM3.5E	151.02	78.41	58.45	37.35	20.59	13.7	37.35
RM4.5E	80.42	80.17	59.12	41.87	18.99	8.57	41.87
RM5.5E	62.08	61.84	61.84	53.19	22.61	10.18	22.61
RM6.5E	76.65	27.63	24.41	23.10	12.89	9.6	26.16
SwanIs	520.82	193.93	124.54	47.88	11.13	6.23	47.88
RM11E	445.34	153.26	89.14	42.85	14.4	5.72	42.85
RM3.9W	22.91	22.91	22.91	22.69	19.68	14.52	22.69
RM5W	26.78	26.52	24.86	24.04	16.73	9.83	24.04
RM6Nav	30.28	26.92	21.03	16.56	5.96	2.67	24.24
RM6W	40.48	18.33	15.78	13.25	7.94	3.46	15.78
RM7W	142.54	67.68	45.86	31.02	17.84	5.81	17.84
RM9W	302.68	127.36	89.02	46.26	13.85	7.81	46.26

 below background
 below equilibrium
 all in ug/kg

2. Surface water background needs to be considered.

As discussed in Section 3.2, surface water PRGs are not appropriate and these PRGs should be eliminated. If they were to be maintained, surface water background must be considered. The LWG collected upriver surface water samples as part of the RI and data were evaluated statistically to assess background concentrations, as presented in the Draft and Draft Final RI reports (Integral et al. 2009, 2011). EPA eliminated the discussion of surface water background concentrations from the final version of the RI and did not consider them in the FS. PRGs should be set by consideration of risk-based threshold concentrations, background, and practical quantitation limits.

Even if surface water PRGs are not maintained, the background surface water concentration is still an important consideration for assessing the effectiveness of the sediment cleanup. Surface water concentrations affect fish tissue concentrations. Therefore, relationships statistically determined between sediment and tissue as modeled by the FWM or determined otherwise, consider surface

water concentrations. Residual and post-construction risk concentrations must consider the impacts of surface water background concentrations. A sediment cleanup in Portland Harbor will not change the incoming surface water concentrations, and a remedial action that specifies tissue concentrations to be met and does not consider background surface water concentrations is unachievable. As discussed above, the Portland Harbor CERCLA actions are not a tool for watershed management; they should only address legacy sediment contamination within the Site. Surface water background needs to be considered before a remedy can be selected.

The upper confidence limits (UCLs) of upriver surface water concentrations of key COCs reported in the draft final RI (Integral et al. 2011) are orders of magnitude higher than the ARARs based on water quality criteria (although Oregon would not determine compliance with its WQS based on a UCL³⁸).

Background concentrations of several contaminants, and the need to consider them in the remedy decision process for Portland Harbor, are consistent with the Clean Water Act 303d list for the Willamette River for these same contaminants upstream of the Portland Harbor Superfund Site. The 303d listing extends from RM 0 to 72 for DDT and PCB and from RM 0 to 186 for dioxin.

Background surface water values can be compared using the UCLs for upriver surface water (dissolved concentrations with outliers removed; Table 7-4b of RI) and RAO3 ambient water quality criteria (AWQC) based PRGs. For example, the upriver UCL³⁹ concentrations for DDT, PCBs, and TCDD toxicity equivalent (TEQ) are all significantly higher than the respective ARAR-based PRGs for these substances:

- Background UCL for DDT = 0.000114 µg/L and the ARAR (RAO3) is 0.000022 µg/L
- Background UCL for PCBs = 0.000126 µg/L and the ARAR (RAO3) is 0.0000064 µg/L
- Background UCL for TCDD TEQ = 0.000126 µg/L and the ARAR (RAO3) is 0.0000000005 µg/L.

³⁸ Oregon DEQ rules establish that all aquatic protection water quality standards are applied as a 96-hour average concentration, which may not be exceeded more than once every three years. OAR 340-041-8033, Table 30. Oregon guidance establishes that its human health criteria should be evaluated based on the geometric mean of 24-hour composite samples of high and low flow conditions of the water body. Oregon DEQ, Reasonable Potential Analysis Process for Toxic Pollutants, Feb 13, 2012, at 34 and 80.

³⁹ As noted above, Oregon's water quality standards are not meant to be applied to a UCL and, therefore, if they are adopted as PRGs, measured concentrations would not be compared on a UCL basis. However, to the extent EPA were to establish PRGs based on these background UCLs, then it would be appropriate to determine compliance with these particular PRGs on a UCL basis.

Not only should these upriver data be used to adjust surface-water-based PRGs, they should also be considered for use in the FWM (including evaluating long-term impacts as part of remedy selection). EPA attempted to calculate sediment PRGs for PCBs for RAOs 2 and 6 using average fish tissue concentrations and AWQC for surface water inputs to the FWM, which resulted in very low or even “0” value PRGs for RAO 2. This then resulted in defaulting to sediment background for PCBs (and for DDX as well). As discussed previously, remediation to the current EPA-defined background levels is not realistically achievable.

3. Background fish tissue needs to be considered.

The Proposed Plan acknowledges that fish consumption risks cannot be attributed wholly to the site. Yet EPA did not include an evaluation of upstream fish tissue data or the background risk associated with consumption of fish not impacted by Portland Harbor. The following summary of regional tissue concentrations was provided in the Final RI and BHHRA. However, these studies are older and less focused than the upstream fish samples collected specifically for the Portland Harbor RI.

PCBs and dioxins/furans have been detected in fish tissue collected in the Willamette and Columbia rivers, outside of the Site. In the Columbia River, the basin-wide average concentrations of PCBs in each resident fish species ranged from 32 to 173 µg/kg for whole body samples and from 33 to 190 µg/kg for fillet-with-skin-and-scales samples (USEPA 2002). In the middle Willamette River (RM 26.5 to 72), the average concentrations of PCBs in resident fish ranged from 86 to 146 µg/kg for whole body samples and from 26 to 71 µg/kg for fillet-with-skin samples (EVS 2000). The regional tissue concentrations may be associated with unacceptable risks from fish consumption, especially at higher consumption rates. However, these regional concentrations are lower than the concentrations detected in the Site, where average concentrations ranged from 16 to 2,800 µg/kg in whole body samples and from 0.17 to 2.5 mg/kg in fillet with skin samples. The fish species included in the studies⁴⁰ were different from those collected within the Site, so the concentrations may not be directly comparable.

The Final RI provides tissue data for smallmouth bass collected from upstream of the site, with detected concentrations of PCBs in whole body tissue samples from 123 to 317 µg/kg with a mean of 238 µg/kg. Applying the whole-body-to-fillet conversion factor used in the BHHRA yields a mean smallmouth bass fillet concentration of 38 µg/kg, which can be considered a “background” level for fish. The average smallmouth bass fillet concentration from the site was 166 µg/kg or approximately 4 times the

⁴⁰ The fish species collected from the Columbia River included five anadromous species (Pacific lamprey, smelt, coho salmon, fall and spring Chinook salmon, steelhead) and six resident species (largescale sucker, bridgelip sucker, mountain whitefish, rainbow trout, white sturgeon, walleye). The fish species collected from the Willamette River included four fish species (smallmouth bass, common carp, northern pikeminnow, and largescale sucker) selected to be representative of bottom fish and predatory fish being consumed by anglers.

background value. In contrast, the Proposed Plan's RAO 2 PCB PRG for edible fish tissues is 0.25 µg/kg, two orders of magnitude lower than the background smallmouth bass fillet concentration of 38 µg/kg. EPA neglects to recognize this limitation and seems to have ignored this important aspect of risk management.

No real consideration of the limitations of background conditions was used in setting target risks or PRGs, although a tissue concentration of 23 µg/kg was identified as being associated with EPA's estimated background-based final sediment PRG of 9 µg/kg (FS Table J1-2), corresponding to a risk of 5×10^{-5} . A more reasonable value for "background" conditions would be the sediment equilibrium value of 20 µg/kg. The fish tissue concentrations corresponding to a sediment concentration of 20 µg/kg is likely closer to 38 µg/kg and possibly as high as 50 µg/kg, which would be closer to a risk of 1×10^{-4} .

The FS correctly concludes that the majority of potential sitewide human health risk arises from exposure to PCBs through fish consumption. However, there are additional human health risks associated with ingestion of upstream fish and with ingestion of site fish tissues containing non-site-related mercury. EPA's FS estimates that Alternative B would reduce sitewide PCB sediment concentrations to 74 µg/kg after 4 years of construction, a 64% reduction from EPA's elevated starting sitewide SWAC of 208 µg/kg. EPA's Preferred Alternative would take nearly twice as long to complete, but would only reduce the sitewide PCB SWAC by an additional 17%, to 40 µg/kg. This concentration is actually in the range of sitewide sediment concentrations measured in 2014 (Kleinfelder 2015), suggesting that the estimated benefit from the Preferred Alternative has already been at least partly achieved through natural recovery. Notwithstanding the additional time and cost (about 4 years and \$350 million by EPA's estimate), the approach proposed by EPA would not support any allowable increase in fish meals at the end of construction. Regardless of the cleanup constructed, the most vulnerable subsistence fisher would still be restricted to only one resident fish meal per month from the site as a consequence of upstream-sourced mercury in Site fish. The OHA advises healthy adults to eat no more than one 8-ounce resident fish meal per month due to PCBs in the Portland Harbor Site (under current conditions) and four 8-ounce meals due to mercury in the Willamette River main stem, which includes the Portland Harbor Site). The mercury advisory is expected to remain unchanged after any remediation in the Site.

At this Site, EPA is relying on unsupported assumptions, making determinations without a basis in reason or science, and is misleading the public about what can be achieved in a manner that is arbitrary and capricious. EPA does not have a sound technical basis for representing that the PRGs are achievable at the Site. The extremely low concentrations of PCBs in sediments and fish tissue used for RGs are not attainable, as demonstrated by the upstream PCB tissue data and by reference data from the Columbia River. EPA's claims that CERCLA-related fish advisories will be

removed when cleanup goals are met and protectiveness is achieved is disingenuous and misleading to the public because it is not made clear that the advisories related to mercury would remain in place. The Proposed Plan acknowledges that, regardless of which alternative is selected, fish advisories will be unchanged for mercury and other contaminants for which there is no relationship between fish tissue and Site sediment concentrations. In evaluating risk reduction at the Site it is important to emphasize that the mercury fish advisory will not be removed because the source of mercury is unrelated to Portland Harbor (e.g., upstream watershed soils, upstream historical gold mining activities, and regional and global combustion sources⁴¹) and therefore beyond the scope of the Superfund cleanup to address. No amount of dredging in the Site would address those upstream sources.

Also, other public health agencies balance the potential health effects from contaminants against the benefits from eating fish (Stone and Uesugi 2011; USEPA 2016c). In its FS and Proposed Plan, EPA has given no indication that it has similarly considered the benefits from eating fish in establishing its very conservative “fish meals per 10 years” amounts.

4.4 Natural Recovery in the Dynamic Willamette River System Needs to be Appropriately Considered, Including using a Sediment Transport Model.

EVRAZ appreciates EPA’s acknowledgement of natural recovery occurring at the Portland Harbor Superfund Site and the use of MNR in the Proposed Plan to address areas outside of sediment management areas. However, the use of MNR deserves further consideration in areas identified for active remediation, and a hydrodynamic sediment transport model is an important tool for assessing the potential for and magnitude of natural recovery. The Proposed Plan does not adequately address baseline conditions as they are now, nor does it consider natural recovery before and immediately after construction. The selection of a Preferred Alternative needs to consider modeled natural recovery processes and to include this information as one of the lines of evidence in assessing the ability of MNR to be effective in additional areas of the site. EPA’s decision to ignore modeling work conducted to date and not use any model to assess recovery at a large dynamic sediment sites is inconsistent with guidance and practice and is arbitrary and capricious.

4.4.1 Recent Site Data Demonstrating Natural Recovery Should Not be Ignored.

As discussed in Section 4.1, additional sampling has demonstrated that natural recovery is occurring at the site. The data set used in the RI/FS is outdated and EPA has decided to ignore recovery implications of more recent data (Kleinfelder 2014). Similarly, the LWG fish tissue data should be considered with respect to recovery. RI/FS data are not representative and should not be used to select a remedy. Further characterization and refinement of the model should be completed before issuing a ROD, or the ROD should

⁴¹ <http://www.deq.state.or.us/wq/standards/docs/MercuryORwaters.pdf>.

allow for revisiting PRGs, RALs, and remedial action areas during design (including sampling, data analysis and modeling of site conditions).

4.4.2 EPA's Treatment of Natural Recovery is Inconsistent and Needs to be Fixed.

EPA evaluates natural recovery outside of sediment management areas in FS Appendix D as part of its comparison of alternatives. Page 4-5 of the FS reads, "EPA is using six lines of evidence to evaluate the effectiveness [sic, missing "of"] natural recovery in this FS" (USEPA and CDM Smith 2016). However, it is not clear how any natural recovery effectiveness is applied or used for decision making. First, Appendix D identifies two areas that are unfavorable for recovery (score of -1); one of these unfavorable areas, referred to as SDU RM 6NAV actually gets higher RALs (a less aggressive remedy of Alternative B +PTW) despite its classification. The appendix indicates the rest of the areas considered are less likely to be depositional (scores of 0). We don't agree with the conclusions of this evaluation and EPA does not seem to either as they assign MNR to areas outside of sediment management areas. Their FS also states that they expect recovery to their low background values in 30 years. The determination that these areas are neutral or less likely to recover are contrary to most lines of evidence, including bathymetric measurements, and recent sediment and tissue data collected from the site. Particularly for SDU 2E, the findings are contrary to documented deposition, the historical presence of a large depositional bar, known as the Post Office Bar, and the need for maintenance dredging in the Navigation Channel.

Recovery discussions are further confounded on FS Page 4-5 where EPA makes a statement about recovery and the application of the information in Appendix D. The FS states "The evaluation of protection and risk reduction due to natural processes will be made based on the concentration reductions and residual risk at the completion of construction (at MNR Year 0⁴²) relative to interim risk-based targets and the six lines of evidence for MNR presented in Appendix D8" (USEPA and CDM Smith 2016). It's unclear how any protection due to natural processes was calculated in the FS including Appendix D8. The protectiveness and risk reduction for the remedial alternatives was estimated solely by EPA replacing starting sediment concentrations with a zero concentration in the dredged and capped areas.

4.4.3 A Hydrodynamic Sediment Transport Model Must be Used to Evaluate Site Conditions.

EVRAZ believes that, consistent with guidance, the remedy should not be issued without the perspective provided by a hydrodynamic sediment transport model. Section 4.1.2 of the FS and Appendix H discuss EPA's weak rationale for not using the hydrodynamic sediment transport model which ultimately results in an arbitrary remedy. The Site

⁴² The concept of MNR Year 0 is only cited once (on page 4-5) in the FS. This points to the rushed nature of the FS, where unconventional terms (that confuse the reader) appear randomly in the document.

presents a complex environmental problem and not using a model is simply bad practice. Current technology makes it impossible to measure the actual processes while they occur in nature. Therefore, measurement of these environmental processes is often limited to snapshots like bathymetric surveys. Numerical models provide a tool to tie together these snapshots and reproduce the underlying processes. EPA has recognized the value of numerical models in their *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (USEPA 2005) and in several other sites around the US where models are used as part of the design and decision making. It is understood that models have limitations, but they are a better option than guessing or adding unsubstantiated additional conservatism to account for uncertainties.

EPA has acknowledged the necessity of understanding the underlying sediment transport processes for the Site. Appendix H of the EPA FS points to the main problem that just relying on bathymetric snapshots could entail.

“Erosion of contaminated material may occur even when limited changes in sediment bed elevation are observed or predicted due to initial erosion of the sediment bed during high flow events followed by subsequent deposition as currents slow and material drops out of suspension.”

In this paragraph EPA recognizes the importance of the complex environmental processes, and therefore it is surprising that EPA would decide to discard the hydrodynamic and sediment transport model altogether and resort to snapshots of bathymetry as the main line of evidence for the design of a billion-dollar remedy.

The model should not be discarded because it has limitations. A numerical model will, by definition, have limitations on the interpretation of reality. A model cannot be used as an absolute value predictor, but rather the model offers insight and confidence on how relevant certain processes are in comparison to others. It is the way to understand what variables and processes are first order to the problem. Models can guide future field work, and are needed to expand and improve the knowledge on the site. Discarding the HST model is discarding decades of knowledge development on the utility of numerical models for sites just like this, and discarding more than 10 years of study on the Site.

In addition, the reasons for discarding the model are not nearly sufficient. The model limitations pointed out by EPA are for the most part solvable and are not limitations of the model itself. Furthermore, the magnitude of these limitations does not prevent the model from being used to inform the design and decision making as one line of evidence. EPA comments on the LWG model from Appendix H are addressed in detail in Attachment 3. This analysis makes it clear that the summation of EPA’s identified model “shortcomings” do not disqualify the existing model as a useful tool. The LWG has been willing to work with EPA to refine the model, a common approach between the EPA and performing parties, but EPA has not been willing to work to refine the model. EVRAZ has already

addressed one of the limitations of the model related to the downstream boundary condition.

The consequences of discarding the model are significant. Without a model, the lines of evidence based on only limited empirical data result in a significant overdesign to compensate for uncertainties. Without a model, it is difficult to understand the causes of the changes in condition identified by future monitoring. Not using a model in a complex system like the Portland Harbor Site is directly contrary to current professional best practices.

Lastly, EPA's decision is arbitrary and untimely. This decision comes after several years of model development effort that resulted in EPA approval in 2010 for the model to be used by the LWG, as is acknowledged in Appendix H. It is unclear and confusing why EPA suddenly decided not to use the model altogether. At the same time, recent sediment data collected in 2014 shows agreement with the fate and transport model predictions in most of the domain, providing confidence that the model is a valuable tool. Further, additional sampling that could, leading to additional model refinement, could be readily accomplished.

4.4.4 Considering Natural Recovery, Smaller Alternatives Reach the Same End-point.

EPA needs to consider natural recovery that has occurred since the RI sampling and that will occur during the design process and implementation and for a reasonable time-frame post-construction in its alternatives analysis. As shown in a simplistic modeling effort for the RM2-3 area, the SWACs for Alternatives B and E are essentially the same when natural recovery is considered (Attachment 4). In its comment on the Proposed Plan, the LWG presents figures⁴³ illustrating how natural recovery will bring Alternatives B and E to the same PCB sitewide SWAC over time.

5 RAL DEVELOPMENT AND APPLICATION

EVRAZ supports and incorporates by reference herein the LWG comments with respect to RAL development including that for the RALs for dioxin/furan, PAHs, and DDx.

5.1 Technology Assignments are Overly Prescriptive and do Not Include Flexibility for Design-level Considerations.

Technology assignment flow charts (Proposed Plan Figures 10a-d) need very significant modification before inclusion in a ROD. These figures are derived by figures in the EPA FS, specifically a multi-criteria decision matrix (FS Figure 3.4-16) and technology assignment flow charts (FS Figures 3.8-1a to d). From the perspective of comparing remedies in an FS,

⁴³ Figures 7 through 9 of LWG Comments on Proposed Plan.

these were a reasonable approach for FS-level evaluation. However, they do not include the necessary flexibility for remedy design and implementation and should not be carried forward into the ROD without very significant modification.

Specifically, if the ROD is to include technology assignment flow charts, they would need to have the flexibility to allow for consideration of new information, site-specific considerations, and technology improvements during design. EVRAZ agrees with the LWG that EPA should set forth in the ROD an overall process consistent with that explained in Section VI and provided as Figure 12 of the LWG comments.

It should then also include the flow chart specifically addressing technology assignments as provided in the LWG Comments on the Proposed Plan as Attachment 21 and attached hereto as Figure A. If, however, EPA retains some form of the Proposed Plan Figures 10a-d, they should be modified per the recommendations set forth in Attachment 5 to allow for flexibility to address site-specific conditions such as:

- Performance-based application of any reactive residual layer (e.g., flow chart requires placement of reactive residual layer regardless of post-dredge sediment conditions)
- Consideration of site specific chemical and physical conditions in determining the need for reactive materials or armoring of caps
- Capping in navigation channel if authorized navigation depth could be accommodated
- Partial dredge and cap in NAV/FMD areas where bathymetric conditions would allow.
- Use of alternative technologies, such as *in situ* remediation or EMNR where physical site constraints preclude placement of cap materials under structures.

The multi-criteria decision matrix used for technology assessment and scoring provided in FS Figure 3.4-16 is not understandable and not helpful in terms of assignment of technologies. In addition, the simplistic 1, 0, -1 scoring (yes-no approach) is not representative of the relative factors considered during selection of capping versus dredging for a given area. The figures in Appendix D (D8-1 through D8-7) show a similar scoring approach, but it is unclear how or if they feed into the multi-criteria decision matrix or if they are a separate analysis. We note that this matrix was not carried forward into the Proposed Plan, so we assume that it was used solely for costing purposes in the FS. In lieu of the multi-criteria decision matrix, the ROD should use demonstration/decision criteria, such as those presented in LWG's Attachment 21 (provided here as Figure A) or in the redlined flow charts in Attachment 5 to this letter.

If the matrix and flow charts are to remain in the FS or have any purpose going forward into implementation, we request that EPA explain this approach and how it calculated the outcomes for SDUs 2E, 3.5E, and 9W for the development of the remedial alternatives. If it is in any way incorporated into the ROD, the multi-criteria decision matrix and flow charts must be flexible and allow for incorporation of additional information from remedial design studies, area-specific conditions, and studies of remedial technologies during remedy implementation.

5.2 RALs Need to be Consistently Applied Across the Site.

EPA's Proposed Plan arbitrarily establishes different levels of cleanup for different areas of the Site. The Proposed Plan states:

Initially, Alternative E achieved the best proportion of the first three balancing criteria when compared to overall costs. However, a more detailed evaluation of the effectiveness of all alternatives on a SDU-scale indicated that some areas of the Site could use a less aggressive alternative than alternative E while other areas needed a more aggressive alternative to meet the specific factors above.

EPA is recommending a remedial alternative (Alt I) that results in cleanup to different RALs in different portions of the site (Table 13 and Figure 9 of EPA's Proposed Plan). While EVRAZ (SDU 2E) is assigned to Alternative E RALs, one SDU is assigned to Alternative "B + PTW" RALs and two SDUs are slated to clean up to Alternative D RALs. If considering PCBs only, Alternatives E and "B + PTW" are synonymous. For SDU 6W where cleanup will be to the Alt D RAL, PCBs will be remediated to concentrations of 500 µg/kg, and for SDU 2E, designated by the Alt E RAL, PCBs will be remediated to 200 µg/kg. Given that the analysis of alternatives is evaluated on an SDU basis, driven mainly by RAO 2 risks, there appears to be no technically defensible basis for selecting 500 µg/kg for PCBs as protective in some areas but not others. If 500 µg/kg PCBs can be protective for some areas, then that should be the PCB RAL for all areas (and sitewide).

Additionally, EVRAZ is being held to a higher standard for DDx, dioxins, and tPAH than SDU 6W: a sediment unit associated with carcinogenic PAHs (from a historical manufactured gas plant). Based on the FS data, those chemicals do not drive the remedial footprint in SDU 2E. However, more data will be collected during pre-design sampling, and disparate RALs would affect the cleanup standards that EVRAZ would have to meet. Similarly, those SDUs where higher RALs are deemed to be sufficient (those with Alternatives B and D RALs) have limited dioxin/furan data in the FS dataset. During remedial design, additional sampling will be conducted, and additional risk associated with dioxin/furan may be identified. And yet, based on higher RALs, higher risk in these SDUs would be considered acceptable while other SDUs, including SDU 2E, would be held to more conservative dioxin/furan RALs. One of these areas with laxer dioxin/furan RALs is RM6.5E, downstream of a known dioxin/furan source, the McCormick and Baxter Superfund Site.

Writing these varying RALs into the ROD holds EVRAZ to a higher standard and gives other PRPs a pass for ubiquitous contaminants. This is especially problematic, given the trends in urban settings for PCBs to decrease over time and PAHs and dioxins/furans to increase over time. SDU 2E is in a depositional zone, historically termed the Post Office Bar. Regardless of any source control actions conducted in the upland (riverbank excavation and stabilization activities took place in 2015) or sediment remedies performed in SDU2E, our section of the harbor may appear to never meet goals for widespread, urban-sourced chemicals (non-point source pollution) due to a combination of lower RALs for dioxins and PAHs and being depositional with finer grained more organic carbon.

6 VARIOUS, POORLY DOCUMENTED SWAC EVALUATIONS CAUSE CONFUSION AND HIGHLIGHT EVALUATION UNCERTAINTY.

EPA cites various SWACs, without clear explanation of what is used in which analyses. This demonstrates that production of the FS was rushed and that it was assembled without the necessary consideration and quality control. The different appendices describing SWACs and 95% UCLs on those averages include:

- Appendix B: develops relationships (bioaccumulation factor) between PCBs (and other chemicals) in fish tissue and an average of PCBs in sediment over the home range (or exposure area) of the sampled organism. This is the basis for the development of the sediment PRGs related to seafood consumption (RAOs 2 and 6). This relationship is used to derive sediment concentrations associated with safe levels of PCBs in fish tissue. EPA describes a method using natural-neighbors interpolation and averaging across a fish's exposure area to develop the sediment SWACs paired with tissue data⁴⁴. In Table B1-4, the starting PCB sitewide SWAC is listed as 92.6 µg/kg, presumably related to averaging of the values used in the smallmouth bass exposure areas.
- Appendix I: An uncertainty analysis presenting five methods to interpolate surface sediment data. The starting PCB sitewide SWACs are presented as a range from 79 to 205 µg/kg. Appendix I also describes methods to find lower and upper 95% confidence limits on the SWACs. A confidence limit of 67 to 95 µg/kg on the natural-neighbors method is presented in text and figures.⁴⁵

⁴⁴ Page B-2: "Because it is not known whether smallmouth bass foraged upstream or downstream from their collection point, 1-river-mile (RM) exposure areas at 0.1-mile increments were evaluated ranging from one mile upstream to one mile downstream of the collection location of each smallmouth bass in a given composite, with boundaries perpendicular to the river course. The number of 1-mile exposure areas averaged for each composite varied, up to a maximum of 10 for each collection location. The SWACs associated with each composite were then averaged."

⁴⁵ Page I-6: "Conditionally simulated SWACs for PCB concentrations varied from approximately 67 to 95 with an average of 79 prior to remediation, which was equal to the SWAC estimated from the average of the natural neighbor surface (Figure I-5)". However, according to Table I-5, the method with a SWAC of 79 µg/kg is listed as "Stratified on RAL Areas with Thiessen Polygons", while the natural neighbors method has a listed SWAC of 80 µg/kg.

- Appendix J: Starting sitewide SWACs (identified as Alternative A) and post-construction SWACs are provided. The post-construction SWACs are used to back-calculate fish tissue concentrations, and ultimately risks, associated with each remedial alternative. In Table J2.3-1a, the starting PCB sitewide SWAC is listed as 208 µg/kg. According to text on Page J-3, this value is a 95% UCL of a SWAC. The Alternative B sitewide SWAC for PCBs is 74 µg/kg (Table J2.3-1b).

As can be seen, various SWACs are available to characterize the starting and post-construction conditions of the Site. The FS and Proposed Plan do not fully document which methods were used for which analyses and, therefore, the findings from these analyses are difficult to understand. It is not always clear whether an average or a 95% UCL is being used, and, depending upon what is presented, the apparent benefits of an action can change. The values used in decision making and remedy selection must be clearly articulated.

6.1 The Acknowledged Uncertainty Needs to be Clarified and Reflected in Decision Making.

Appendix I (Surface Weighted Average Uncertainty Analysis) looks at various methods for calculating SWACs “consistent with the recommendation provided [*sic*] the joint National Remedy Review Board/Contaminated Sediments Technical Advisory Group Comments on the proposed remedy”.⁴⁶

We support an evaluation of the uncertainty associated with various interpolation and statistical methods, as well as an understanding of how the aging of the data affects the understanding of Site conditions. EPA acknowledged in Appendix I that there is a large range of uncertainty associated with the calculation of the SWACs. However, this uncertainty needs to be clearly documented and carried forward in decision making. The uncertainty is not communicated into Appendix J where post-construction risks estimates, which form the basis for remedy selection, are reported. EPA selects an aggressive alternative for which incremental risk reduction is promised. In reality, the risk reduction for Alternative I is well within the range of uncertainty of risk reduction amongst all alternatives.

Appendix I indicates that Figure I-6 “Surface Weighted Average Concentration for PCBs vs. RALs” suggests the entire range of sitewide starting SWACs for PCBs is represented by a gray horizontal band. However, the text later clarifies that this graph presents only the range from the lower to upper 95% confidence limit on the natural-neighbors method of data interpolation, ranging from 67 to 95 µg/kg (and it’s not clear if this is really natural neighbors or another method, given the different average values presented [see prior footnote]). Appendix I presents four other methods, with their own outcomes. Considering

⁴⁶ The National Remedy Review Board/Contaminated Sediment Technical Advisory Group (NRRB/CSTAG) comments were on the draft FS and follow-up presentation which included a preferred alternative but preceded the Proposed Plan.

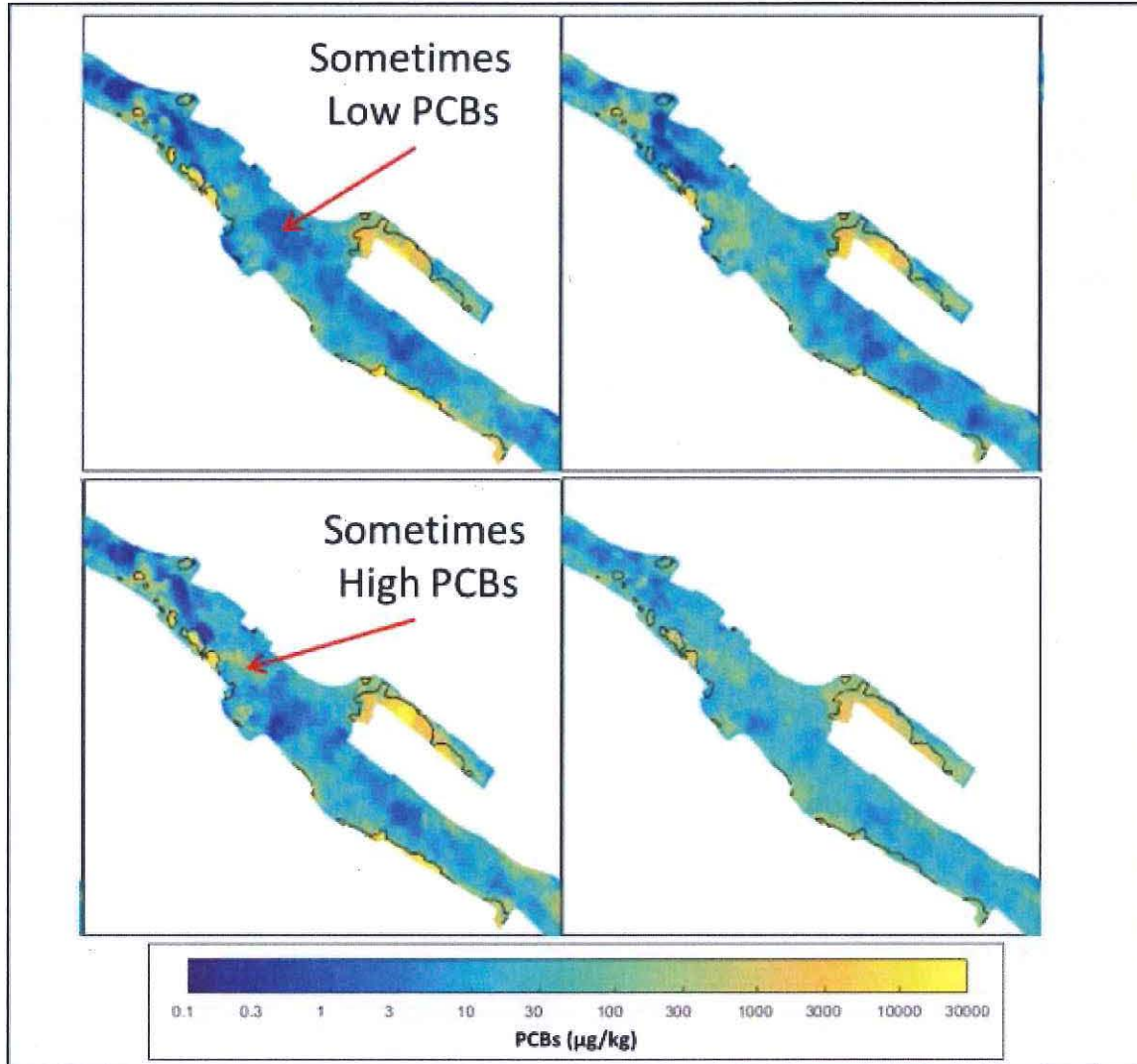
all these methods, the range in possible starting PCB SWACs is much broader than what is shown on Figure I-6. The range in averages from the five interpolation methods is 79 to 205 $\mu\text{g}/\text{kg}$. However, the lower and upper confidence limits on the means from these methods are not reported in Appendix I, so the entire range of starting PCB SWACs is not clear. Based on the averages, the range varies by a factor of more than two.

Based on Table I-3, it appears that the SWACs for other constituents can vary by at least three-fold, yet they are not presented.

6.2 The Descriptions of Interpolation and Averaging Methods Lack Clarity.

Figure I-4 provides one example of the highly uncertain methodology and the lack of clarity in EPA's explanation (provided here as Figure 6-1). It presents four very different maps of interpolated PCB concentrations in surface sediment. None of the maps are labeled, and minimal legend elements are provided, so the reader is left to wonder about the various methods being displayed. But the title of the figure, "Four Equally Likely Simulated Maps of PCBs," suggests that there is a lot that is not known about the sediment condition. This is compounded by the age of the data (discussed above).

Figure 6-1. Four Equally Likely Simulated Maps of PCBs (from FS Figure I-4)



Further, in Appendix I, EPA calculates sitewide SWACs for a set of RALs and uses conditional simulations to estimate confidence limits about the estimated pre-remedial and post-remedial SWACs. The use of a broad range of percentiles of the contaminant distribution (as noted in the last paragraph on page I-3) is not an appropriate way to estimate uncertainty in the SWAC. EPA incorrectly states that when the confidence bands for alternatives and starting SWACs overlap the post-remedy conditions from those alternatives are statistically indistinguishable.

There are no statements in Appendix I to indicate that EPA used these estimated uncertainties to estimate post-construction risks or to select the preferred alternative; although the main text of the FS (USEPA and CDM Smith 2016, p. 4-9) reads:

The analysis showed that for some alternatives, the uncertainty bounds of the post-remedial SWAC overlap the uncertainty bounds of the pre-remedial SWAC. This indicates that there is potentially no remedial benefit for those alternatives because the pre- and post-remedial SWACs are statistically indistinguishable when uncertainty in the SWAC estimates are taken into account.

The statement that “those alternatives...are statistically indistinguishable” is not correct, and is troublesome. Although it’s not clear, it suggests that Alternatives B and D were found to not meet the threshold criteria for protectiveness because of the perception that they are “statistically indistinguishable” from Alternative A. The assertion that datasets with wide ranges of concentrations with potentially overlapping confidence limits on the mean are statistically indistinguishable is flawed, and EPA should not use this faulty premise to favor more aggressive remedies. Further, there is a lack of clarity on the reason that Alternatives B and D were considered protective in the Draft FS, but not in the Draft Final FS.

Additionally, Appendix I includes confusing graphics and overcomplicated “algebra” to present a rather simple concept that a big SWAC reduction occurs when a cleanup addresses consolidated hot spots that are small and contain COC concentrations well above the concentrations in the rest of the site. To support this, EPA presents FS Figure I-3 which shows only a 60% reduction in PCB sitewide SWAC for Alternative I (from the starting sitewide SWAC), which is presumably considered acceptable. However, using the SWACs that EPA used to calculate post-construction risks in Appendix J of the FS, a 64% reduction is achieved by Alternative B (using the starting SWAC at 208 µg/kg in Table J2.3-1a vs Alternative B SWAC of 74 µg/kg in Table J2.3-1b) and an 81% reduction (to 40 µg/kg in Table J2.3-1g) is achieved by Alternative I.

6.3 EPA Falsely Projects a High Degree of Confidence in its Post-Construction Risk Estimates.

In evaluating the remedial alternatives, EPA replaced concentrations in dredged and capped areas with zero. Zero does not accurately reflect post-construction conditions, and it yields an unrealistic data set that appears more uniform with larger remedial footprints. EPA suggests that only the starting SWACs are highly uncertain by stating in Appendix I that: “The uncertainty bounds on SWAC is narrower for lower RAL values reflecting that a larger remedial footprint both reduces the SWAC but also its uncertainty.”

The perceived reduction in uncertainty is because, as the simulated footprint grows, the data set appears to become more uniform as the concentrations in the remediated cells are changed to zero. Following this statement to the extreme, Appendix I’s text concludes

with “If the entire site is remediated, there is no uncertainty.” This would only be true if all sediment in the site could instantaneously be replaced with sediment bearing absolutely zero molecules of PCBs, PAHs, dioxins, or DDx.

In Appendix J, post-construction rolling river mile and SDU average calculations are presented, but they appear to have no relationship to the SWAC calculations described in Appendices B or I (PRG Development and SWAC Uncertainty, respectively) because the data and methods used in all of these appendices (B, I, and J) are ambiguous. The phrase “These sediment concentrations were input into the FWM...” (in the first paragraph of Section J2.3) apparently refers to sitewide SWAC values, but it does not specify whether the concentrations are derived from a straightforward application of the nearest-neighbor method or whether the uncertainties derived from conditional simulations which were used to derive a UCL for the SWAC that was used for the risk assessments.

The LWG requested clarification from EPA regarding the various SWACs presented in the FS. The July 20 response from EPA⁴⁷ describes a method that does not appear to match the methods in Appendices B, I, or J. In the response, EPA indicated they calculated averages within each SDU and then placed those values in its ProUCL software to generate a 95% UCL. The method described in that response is technically incorrect because it gives equal weight to river segments (SDUs) with different surface areas. EPA should document the method used clearly in the FS to support its decision, and if we understand the response to the question correctly, EPA should revise its method because the method indicated is not defensible, especially when it is relied upon by EPA to promise risk reduction for its proposed highly expensive remedial alternatives.

EPA’s selection of the preferred alternative is based upon an overconfidence in its estimated SWACs, which in turn are used to estimate tissue concentrations and the corresponding fish consumption risks. For example, the calculated sitewide cancer risk for Alternative B is 4×10^{-4} , while Alternative D is associated with a 3×10^{-4} risk (Tables J2.3-1b and c). Within the uncertainty in the starting SWAC alone, and with regard to the other issues noted, these two numbers are not different from one another, and EPA’s selection of its Preferred Alternative is not justified.

7 FAULTY RESIDUAL RISK ASSUMPTIONS AND CALCULATIONS SKEW THE REMEDY SELECTION PROCESS AND NEED TO BE CORRECTED.

7.1 EPA Should Revise Spatial Scales to Match Exposure Areas.

Risk-based PRGs and the evaluations of remedial alternative protectiveness, post-construction risks, and residual risks should be evaluated on the exposure area used to characterize risk in the approved BHHRA and BERA. The spatial scale (exposure area) is a

⁴⁷ EPA (K. Koch) response dated July 20, 2016 to Question 8 from LWG.

key element of each exposure scenario being evaluated. EPA used various spatial scales to evaluate site risk, post-construction risk, and residual risk as discussed in the FS (Section 4.1.1): (1) Benthic risk was evaluated as the area exceeding the RAO 5 PRGs, (2) 0.5 river miles were used for RAO 1 for direct contact exposure of people engaged in fishing activities, (3) 1 river mile (split by east and west sides of the river) was used for RAOs 2 and 6 for the dietary exposure of humans and wildlife that consume fish, (4) SDU-based risks were used for RAO 2, and (5) sitewide risks were calculated for RAO 2. Surface sediment concentrations were averaged over a half river mile (RAO 1) or one river mile (RAOs 2 and 6) in successive 0.1-mile increments in both the east and west nearshore segments, and the navigation channel. Averages were found in SDUs, too. Some of the spatial scales match the BHHRA and BERA exposure areas. However, in contrast to the BHHRA and BERA, the FS considers only the east or west side of the river or navigation channel in its SWACs (or each SDU, which is similar to one river mile on one side of the river). Because of this variation or because of other unidentified changes that EPA has employed, post-construction risks cannot be reasonably compared to baseline conditions reported in the BHHRA.

As indicated, three scales were used to derive post-construction and residual risk estimates for RAO 2: sitewide, SDU, and 1 RM. A fish consumption rate of 142 g/day (based on the subsistence fisher) was used for sitewide risk estimates, and a consumption rate of 49 g/day (based on the recreational fisher) was used for SDU and 1 RM calculations. For the recreational fisher, EPA has assumed that anglers spend all of their time fishing in a one-mile segment of the river. Many locations along the river are not accessible to the public except by boat; whether by boat or from the shoreline, it is highly improbable that someone catches 80 fish meals per year for 30 years from the same location. This rate of consumption requires catching at least a pound of whole fish every 2 to 3 days from the same one-mile stretch of the river.⁴⁸ Given this rate of consumption, it would raise questions on the sustainability of the fishery in that area. This highly sustained level of fishing is simply not observed at SDU 2E. The only access to the river at SDU 2E is via boat. Recreational fish consumption risk should be evaluated only on a sitewide basis. This would also be consistent with the manner by which the biota-to-sediment accumulation factors were calculated.

For RAO 6 (ecological consumption of fish) post-construction risks were evaluated on a river mile scale. This corresponds to the home range of species such as smallmouth bass, hooded merganser, osprey, bald eagle, and mink that were evaluated in the BERA. However, ecological risk is managed on a population, not individual, basis. So even if a home range is within a river mile, the contiguous population is exposed over a larger area, and, therefore, post-construction risks should be evaluated on a sitewide basis.

⁴⁸ Assuming 30% of the catch is edible tissue, the RME recreational angler consumption rate of 79 meals per year (49 grams per day) requires catching approximately 130 pounds of whole fish per year.

In summary, the spatial scales, exposure scenarios, and estimation of exposure point concentrations for the remedy development and residual risk evaluations vary from those used in the BHHRA and BERA. No clear rationale is provided for EPA's departure from the approved approaches. These disparate methods and approaches for estimating post-construction risks are overly complicated and misleading.

7.2 The Use of the Food Web Model to Predict Fish Tissue Concentrations Results in Significant Uncertainty.

Estimates of post-construction risk are presented on an SDU basis, roughly one river mile long in either the east or west side of the navigation channel. The FWM was calibrated with smallmouth bass tissue paired with sediment data averaged across the width of the river and a whole river mile upstream and downstream from where the fish were collected. For smallmouth bass, the exposure reach for each composite sample was assumed to be a 1 mile length of the river.

Because it was unknown whether the smallmouth bass would forage upstream or downstream from their collection point, 1-river-mile exposure areas at 0.1-mile increments were evaluated ranging from 1 mile upstream to 1 mile downstream of the collection location of each smallmouth bass in a given composite. Thus there were up to 10 exposure estimates (each being a SWAC covering 1 river mile) for each collection location. The sediment SWACs associated with all of the collection locations for the fish within a composite tissue sample were then averaged. Due to the scatter or closeness of the individual fish collected for each composite tissue sample and the upstream and downstream boundaries of the site (exposure was not estimated for areas beyond study boundaries), the number of 1-mile exposure areas averaged for each composite varied. The 1-mile exposure areas had boundaries perpendicular to the river course; SWACs for these areas were calculated from natural neighbors interpolations.

The paired sediment SWACs and tissue data were used in the FWM to establish a sitewide relationship between sediment chemistry and contaminant levels in fish tissue. That relationship has a higher calculated slope because of the inclusion of lower-concentration sediment from the navigation channel and, in some areas, low concentration areas across the navigation channel from higher concentrations areas (e.g., RM2 to 3). Inclusion of these low-concentration areas generates lower river mile-based sediment SWAC values, which is in the denominator of the PCBs-in-tissue to PCBs-in-sediment ratio.

Therefore, the tissue-to-sediment relationship is relevant on a sitewide scale (or at a minimum, to a full river mile). Instead, EPA is applying the relationship on an SDU-by-SDU basis, approximately a 1-mile river basis but on one side of the channel only and reflecting data that does not generally include the navigation channel and cross-channel areas. Therefore, EPA is applying the relationship to calculate post-construction risks and to make decisions in a manner that is not consistent with how it was established.

EVRAZ investigated the effect of finding PCB SWACs across a whole river mile (river mile 2 to 3) vs. only within an SDU (2E). The methods used in this evaluation are discussed in Attachment 4. The analysis showed the Preferred Alternative (Alt E) in SDU 2E actually results in a higher SWAC than Alternative B yields across the appropriate exposure area (Table 7-1, entire river mile 2 to 3). Therefore, the more costly and disruptive Alternative E is not justified.

Table 7-1. Comparisons of PCB SWACs in SDU 2E to RM 2-3

Averaging Area	PCB SWAC (RV = 9 µg/kg)			
	Alt A	Alt B	Alt D	Alt E
SDU 2E	235	66.3	47.1	37.2
RM 2-3	76.7	32.5	27.5	24.8

Note: bold italicized SWACs are discussed in text.

Also of note are the size of the error bars on Figures B1-21 and B1-39 and similar figures and the general overestimation of tissue concentrations by the FWM, on the order of 2- to 100- (or more) fold depending upon the contaminant. The uncertainty in the fish tissue concentrations' dependence upon sediment concentrations is high. The degree of uncertainty associated with this one parameter alone is greater than the difference in post-construction risk between alternatives.

7.3 EPA's Approach to Post-construction and Residual Risk Estimates Needs to be Revised.

This FS also adopts entirely new methods to estimate pre- and post-construction risks for the remedial alternatives (Appendix J). The post-construction risk evaluation process is neither technically sound nor transparent, and it is not the same thing as a residual risk evaluation, which would look at risk at the end of the thirty year time frame that the FS evaluates as the reasonable time frame within which to meet PRGs.⁴⁹ There is no rationale or a clear example provided for evaluating risk at this time point or for the process used. The FS states that methods used to evaluate post-construction risks are consistent with the baseline risk assessments, but this is not an accurate characterization of these methods. Some examples of differences in risk assessment methods and assumptions include:

- The BHHRA estimated risk based on upper bound sediment and fish tissue concentrations for fish consumption. The same approach was not used in the EPA FS and Proposed Plan. Different data averaging methods and assumptions were utilized for the different SWAC estimates (sitewide vs. rolling river mile, and SDU-wide).

⁴⁹ EPA draft Final FS p. 4-6 ("[A] reasonable time frame...was considered to be 30 years").

- The EPA FS sitewide post-construction risk estimates are based on estimating a sitewide SWAC as the 95% UCL of the SDU-specific SWACs, which ignores spatial differences between SDUs; then uses the FWM to estimate concentrations in 4 fish species and averages those; and then calculates risks based on an ingestion rate for a subsistence fisher of 142 g/day.
- The EPA FS river-mile and SDU-specific post-construction risks utilize a SWAC calculated using different methods from the BHHRA. Those SWACs were then divided by an SDU/RM risk-based sediment PRG and multiplied by 10^{-6} (in the case of cancer endpoints). The ingestion rate used in the calculation of SDU/RM PRGs was 49 g/day. This approach assumes linearity in the FWM, which is not the case. More importantly for PCBs, the SDU/RM risk-based sediment PRG is reported by EPA (Table B3-5) as $0.31 \mu\text{g/kg}$ which is less than even EPA's background of $9 \mu\text{g/kg}$ by 30 times and less than the estimated equilibrium level of $20 \mu\text{g/kg}$ by 65 times. Therefore, the post-construction risks estimated by EPA for the SDUs/RMs (Appendix J) are much higher, by an order of magnitude or more, leading EPA to select a more aggressive remedy to achieve target risk levels. A sediment PRG of $0.31 \mu\text{g/kg}$ is not achievable or measurable, and thus the post-construction risks calculated are meaningless. The SDU/RM PRGs should be based on more realistic PRGs. Even if background is selected as the SDU/RM PRG, like it is for sitewide risks, then a much less aggressive remedy would achieve the PRG post-construction. Furthermore, the low risks estimated in Appendix J for the more aggressive remedies are exaggerated by the use of zero replacement values in calculating post-construction SWACs.
- "Fish meals per 10 years" was not used as a measure of risk levels in the BHHRA, and no rationale was provided in the FS for using this unit, or what it means. It appears it was used to create larger numbers to compare, and thus to exaggerate the perception of the level of risk reduction.
- Some of the tables in Appendix J include arsenic, aldrin, chlordanes, and dieldrin and the dioxin/furan congeners 2,3,7,8-TCDF, 2,3,4,7,8-PeCDF, and 1,2,3,4,7,8-HxCDD in addition to PCBs, DDX, and 2,3,7,8-TCDD. Others are missing cPAHs (such as Table J2.3-1a). There is no explanation for this inconsistent approach other than that the FS was rushed and assembled without the necessary consideration and analysis.
- For dioxins/furans, EPA uses 5 congeners to represent risks from dioxins/furans, whereas the BHHRA used a TEQ which is consistent with guidance and better incorporates the effects of the suite of congeners present in a sample.
- Sufficient explanation for these different approaches is not provided. The lack of consistency and transparency in this process is arbitrary and capricious.

The difference in the risk assessment methods becomes apparent when the risks estimated for Alternative A (no action) in the FS are compared to baseline risks from the BHHRA. Conceptually, these should be the same. However, Table 7-2 shows a 2-fold difference in the sitewide total risk estimate for Alternative A (no action) between the BHHRA and the FS, which is primarily driven by dioxins/furans. The differences in the RAO 2 risk results between the BHHRA and FS are even more significant for certain river miles because the BHHRA appropriately finds fish consumption risk across the entire river mile (consistent with the FWM) while EPA calculates these risks within individual SDUs. The overall RM 2-3 risk is overestimated 7-fold in the FS because the risk is calculated within SDU 2E, instead of across the entire river mile.

Table 7-2. Comparisons of Risk Estimates (RAO 2, Subsistence Fisher) in the BHHRA and FS

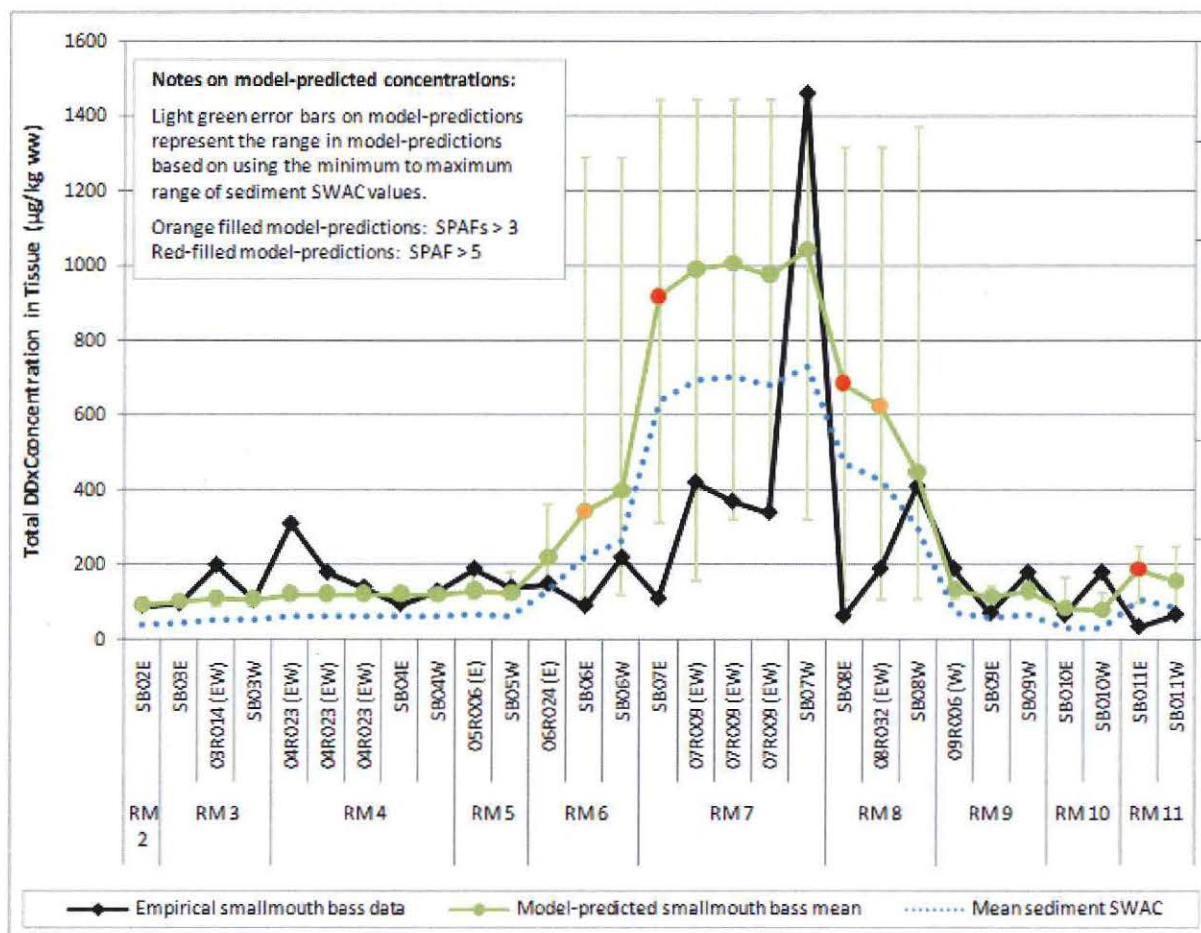
COC	Sitewide		RM 2 - 3	
	BHHRA	FS	BHHRA	FS - SDU 2E
DDx	2×10^{-5}	2×10^{-5}	3×10^{-7}	4×10^{-7}
PCBs	1×10^{-3}	1×10^{-3}	1×10^{-4}	7×10^{-4}
D/F (5 congeners)	NA	9×10^{-4}	NA	2×10^{-5}
D/F (TEQ)	1×10^{-4}	NA	1×10^{-5}	NA
All COCs	1×10^{-3}	2×10^{-3}	1×10^{-4}	7×10^{-4}

7.4 The Level of Uncertainty Means There are No Significant Differences to Warrant Selection of a Remedy.

As discussed previously, the difference in post-construction risks between alternatives is not significant (within a factor of 2-7). This is particularly apparent when the uncertainties associated with the various assumptions and approaches is considered. A number of factors and assumptions went into the post-construction risk estimates that have significant uncertainties: including 1) uncertainties in the derivation of PRGs, which were used to estimate risks from the SWACs; and 2) uncertainties in development of SWACs, including different methods to estimate SWACs, based on rolling river mile, SDU-wide and sitewide. Uncertainties associated with PRG development include the application of the FWM, which is discussed above. An example of this comes from figures provided in Appendix B of the FS, such as the one below for DDx. The FWM predicts fish tissue concentrations at low concentrations in sediment, but overestimates tissue concentrations within the range of concentrations of concern, with error bars that range as much as an

order of magnitude (Figure 7-1, from FS Figure B1-27). Similar uncertainties exist for all of the primary COCs, with the error bars for dioxins/furans spanning 2–3 orders of magnitude. This uncertainty may explain why the EPA FS, which used modeled tissue concentrations, is overestimating dioxin/furan risks by two orders of magnitude from those in the BHHRA which used empirical tissue data.

Figure 7-1. Empirical and Model-Predicted Smallmouth Bass Tissue Concentrations for DDx for RM 2 through RM 11 and for Swan Island Lagoon (FS Figure B1-27)



Other assumptions that result in uncertainties were mentioned previously in this letter, including use of a range of consumption rates and highly conservative assumptions about exposure duration, and the source of fish consumed. As discussed above, Appendix I of the FS presents uncertainties associated with the estimation of SWACs and shows the starting SWAC can vary generally by a factor of 2 or more just due to statistical/spatial methods.⁵⁰

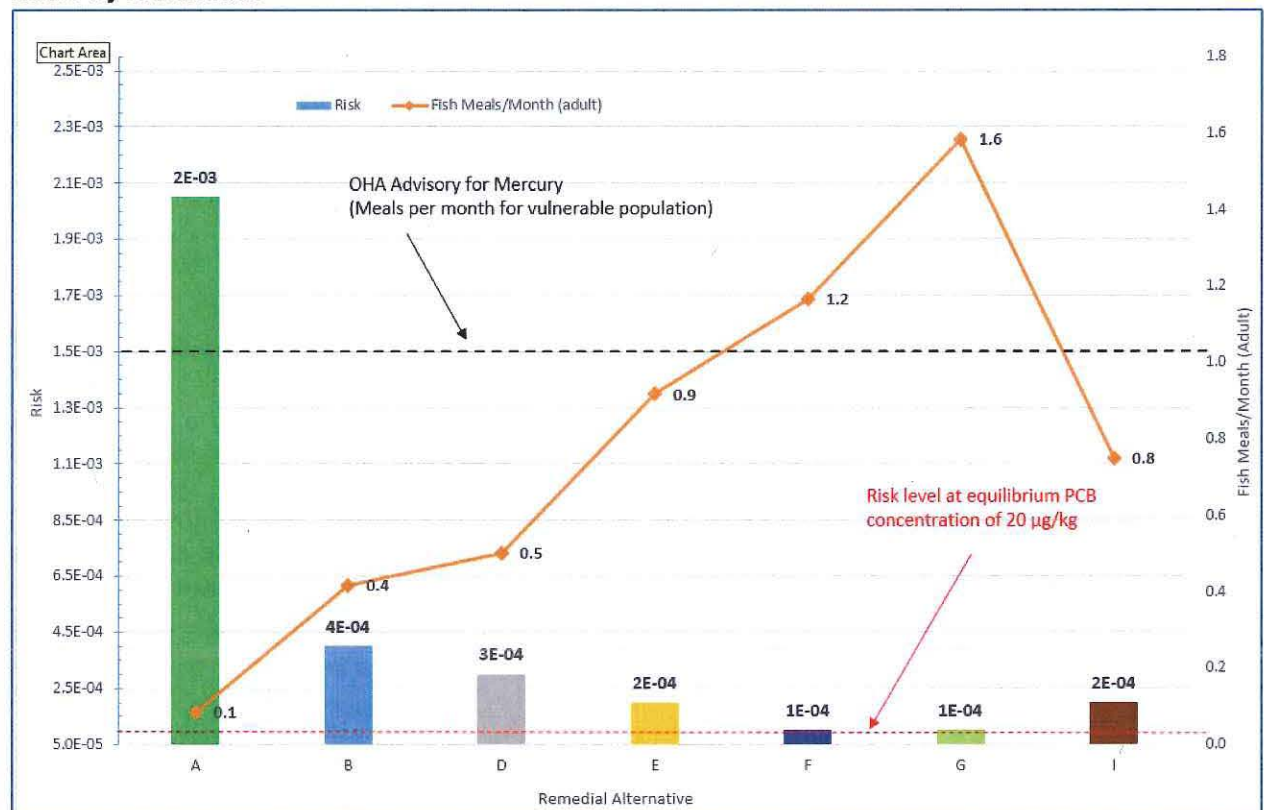
Figure 7-2 demonstrates the small differences in risk reduction from Alternative B through Alternative I, even using EPA's post-construction risk evaluation framework (which, as

⁵⁰ Table I-1 shows are range of starting sitewide SWACs from 80 to 205 µg/kg for PCBs, based on the various interpolation methods examined.

noted above, is not the true risk evaluation, which would be calculated based on projected concentrations at 30 years). Given all the uncertainties listed above, the clear benefit is the removal of high concentrations areas contemplated in Alternative B. The remaining differences are insignificant.

Furthermore, by using the concept of “fish meals per 10 years” in their FS, EPA overemphasizes the risk reduction gained. As shown below, the differences in sitewide post-construction risks between any of the Alternatives from B through G vary by a factor of 2 to 4, not even one order of magnitude. Furthermore, for vulnerable populations, fish meals are already limited by the existing mercury advisory such that remediation beyond Alternative E has no additional benefit. In addition the difference between Alternatives B and E is 0.5 meals per month, or an additional 4 ounces of fish per month. This difference is not significant and does not warrant a more aggressive remedy.

Figure 7-2. Post-Construction Sitewide Human Health Cancer Risk and Acceptable Consumption Rates by Alternative



Note: Based on FS Figure 4.2-2. Fish meals based on 10^{-5} risk. The OHA mercury advisory for healthy adults is 4 meals per month.

7.5 EPA Should Use Previously Agreed upon Methods to Evaluate Benthic and Ecological Risk.

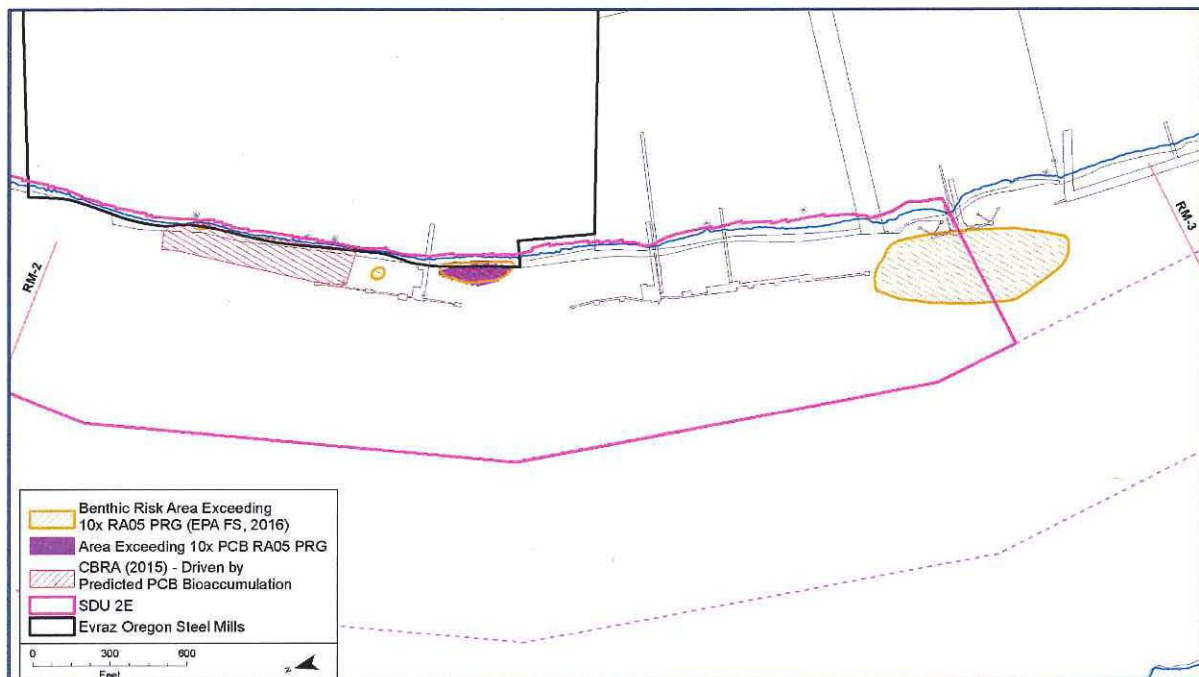
EVRAZ supports and incorporates the LWG comments on the Proposed Plan on benthic and ecological risk by reference herein.

In summary, the EPA FS changed the approach to evaluating protection of benthic invertebrates (RAO 5) from the Comprehensive Benthic Risk Areas (CBRAs) method used in the approved BERA to mapping benthic PRG exceedance factors on a point-by-point basis using sediment concentrations 10 times above the RAO 5 PRGs. This exceedance factor method suggests 1,289 acres (FS pp. 4-16 and FS Figure D-11) of the site present risk to benthic organisms, while the CBRA method, which used empirical bioassay data, showed 55 acres of benthic risk. The Proposed Plan is then inconsistent with the EPA FS, reporting that areas of unacceptable risk to benthic invertebrates account for approximately 4-8% of the site (p. 20), while the total impacted area using EPA's FS approach is approximately 63% of the site. Not only does EPA's approach grossly overestimate areas of the benthic risk, it misses about one third of the benthic areas that the LWG and EPA identified with the approved BERA CBRA approach. This means that the majority of the area targeted for remediation by EPA based on RAO 5 was incorrectly targeted.

EPA's residual risk evaluation for benthic risk included a post-construction interim target for RAO 5 established as a 50% reduction in the area posing unacceptable benthic risk (i.e., the 10X RAO 5 area), which is arbitrary and not related to any quantitative assessment. EPA's FS Table 4.2-7 indicates that Alternative B addresses 48% of the 10X RAO 5 benthic risk area (Alternative I addresses 64%), which is only 2% below the arbitrary interim target. This is within the range of reasonable uncertainty.

For SDU 2E, Figure 7-3 shows EPA's 10X RAO 5 benthic area (orange hatched area from Figure J2.4-3a of EPA's FS), which does not even overlap the BERA-approved CBRA (red striped area). EPA's area, therefore, does not target the area of benthic risk based on empirical toxicity data.

Figure 7-3. Benthic Risk Areas – BERA vs EPA's FS (Modified from USEPA and CDM Smith 2016)



For protection of ecological receptors through bioaccumulation (RAO 6), EPA concluded in FS Section 4.3.1 (and on page 51 of the Proposed Plan) that “Alternatives B, D, E and I do not achieve the ecological HQ interim target of 10.” A brief review of EPA’s results suggests that all of these alternatives are protective. In the FS, EPA refers (p. 4-20) to Figures 4.2-9 through 4.2-17 and Table 4.2-5 to support EPA’s conclusion that the RAO 6 is not met for BEHP. However, Table 4.3-1 shows that, on an SDU basis, this COC only exceeds the HQ of 10 in Alternatives A and B. Numerous issues were identified in these tables and figures as described in the LWG’s Comments on the Proposed Plan (Section I.A) and summarized here:

- The only COC exceeding the arbitrary 10X RAO 6 PRG in the FS data set was BEHP. Its Alternative B post-construction risk on an SDU basis has an HQ of 11; this is only slightly above the arbitrary threshold of 10 and well within the limits of uncertainty.
- The river mile analysis indicates that elevated concentrations of BEHP appear to be in only one SDU (Swan Island) and based on one or two individual samples. This is not sufficient reason to state that Alternative B is not protective on a sitewide basis, when the issue is localized to a handful of samples in one area.
- EPA’s FS (p. 4-42 and 4-80) reports river mile-based BEHP HQs for Alternative B, D, E, and I from 34 to 15, respectively, with Alternatives D and I both having HQs of 19. No rationale is provided by EPA for how an HQ of 34 in a very limited area is

not likely to achieve protectiveness in 30 years while an HQ of 19 is protective in one case, but not in the other, over the same period.

7.6 The Risk Reduction Relative to Background Needs to be Considered.

It is important to achieve risk reduction at the Site. But the basis for the desired outcome should be explained, the outcome should be achievable, and the means to achieve that outcome should be reasonable and cost-effective. EPA's failure to show how its concept of risk reduction meets these basic requirements is an indication, one among many, that its remedy selection process is arbitrary and capricious.

The error bars around the risk reduction estimates need to be considered. The span of risk reduction amongst the alternatives is narrow.

Although background concentrations are provided in the FS for sediments, the Proposed Plan does not provide any specific comparison to background conditions or risk for context. The risk management step during PRG development, as well as the residual risk evaluation, should include a calculation of background risks and considerations of upstream conditions that will limit the ability to achieve RAOs. All risk reduction estimates should be compared to background risks as shown below in Figures 7-4 through 7-6.

Figures 7-4 through 7-6 present post-construction risks for the remedial alternatives relative to PCB background risk (both the LWG's equilibrium of 20 $\mu\text{g}/\text{kg}$ and EPA's background of 9 $\mu\text{g}/\text{kg}$) for SDU 2E. Post-construction risks range from 2×10^{-4} to 6×10^{-5} from Alternative B to G, respectively, which is essentially risk at background at equilibrium. Risk from background PCB at equilibrium (20 $\mu\text{g}/\text{kg}$) is 1×10^{-4} , assumed to be similar to the PCB-related risk from Alternative F (SWAC of 23 $\mu\text{g}/\text{kg}$; Table J2.3-1 of FS). Total risks for Alternative E, F, and G are either at or below background PCBs at equilibrium, meaning that, even if those sediment concentrations were attained immediately post-construction, they could not be sustained based on the higher equilibrium concentration that would be established by incoming sediment loads.

In summary, it is not possible to achieve sitewide risk to the background level of 9 $\mu\text{g}/\text{kg}$ (5×10^{-5}), and no meaningful risk reduction is achieved after Alt B.

Figure 7-4. RAO 2 Fish Consumption Post-Construction Risk Reduction for SDU 2E for the Remedial Alternatives

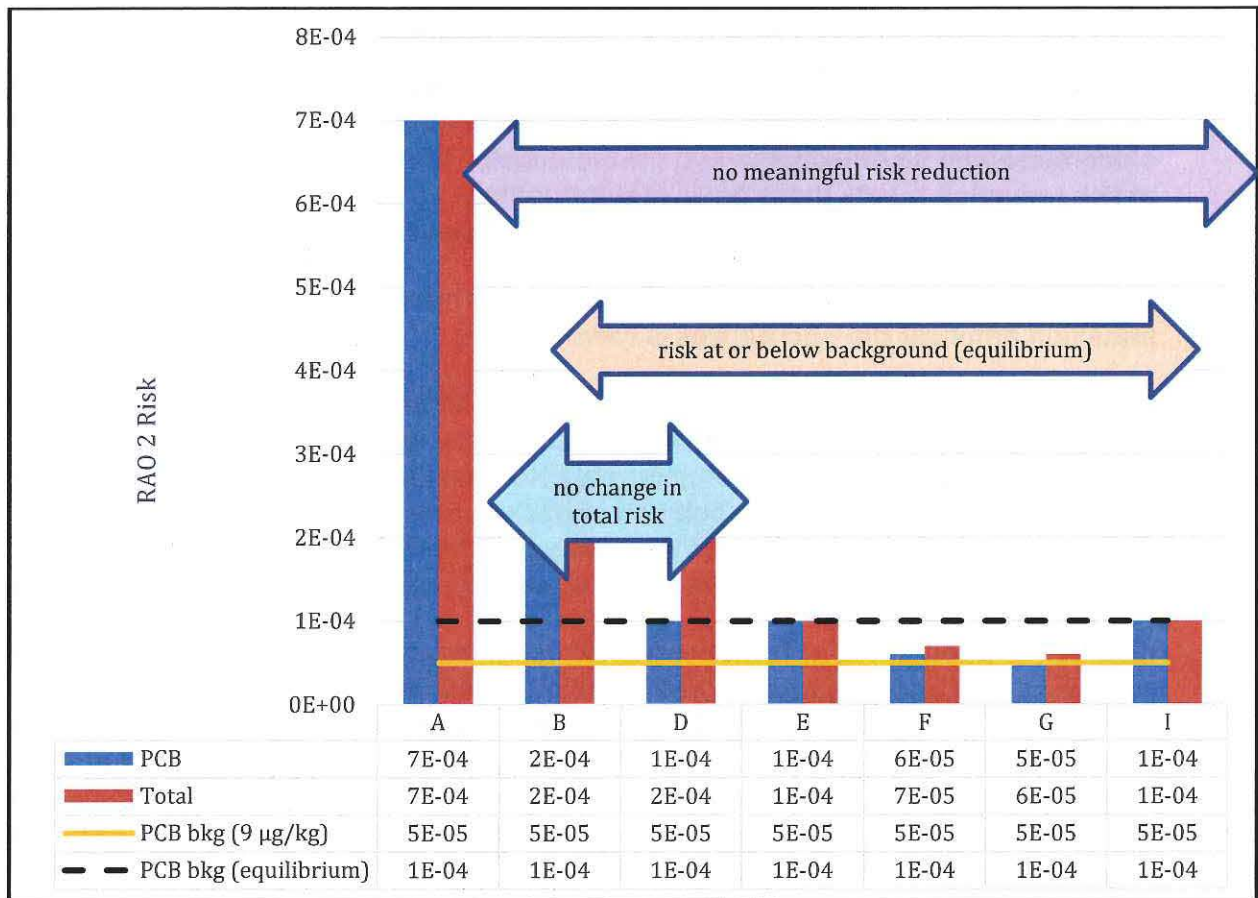


Figure 7-5. RAO 2 Fish Consumption Post-Construction HI (child) Reduction for SDU 2E for the Remedial Alternatives

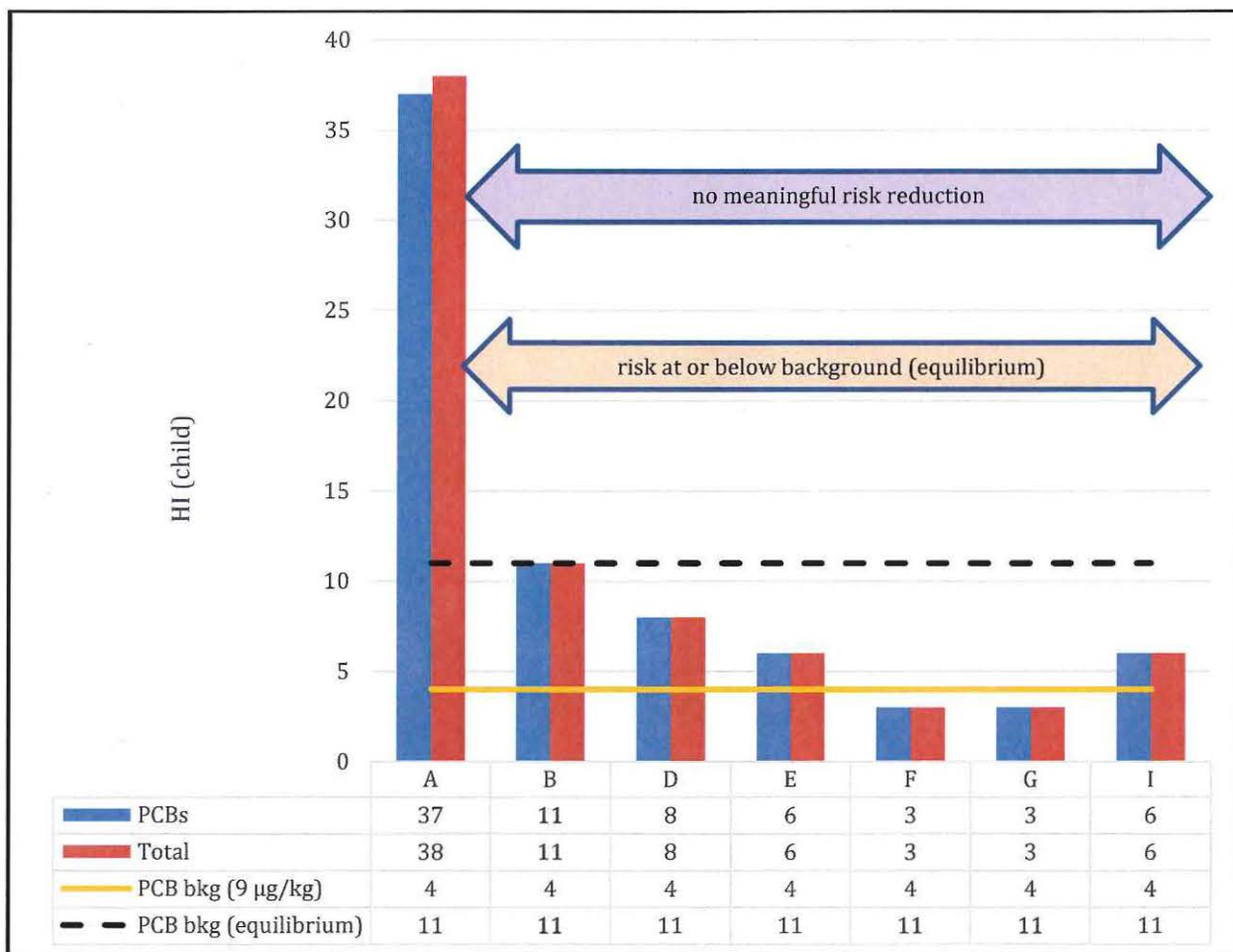


Figure 7-6. RAO 2 Fish Consumption Post-Construction HI (infant) Reduction for SDU 2E for the Remedial Alternatives

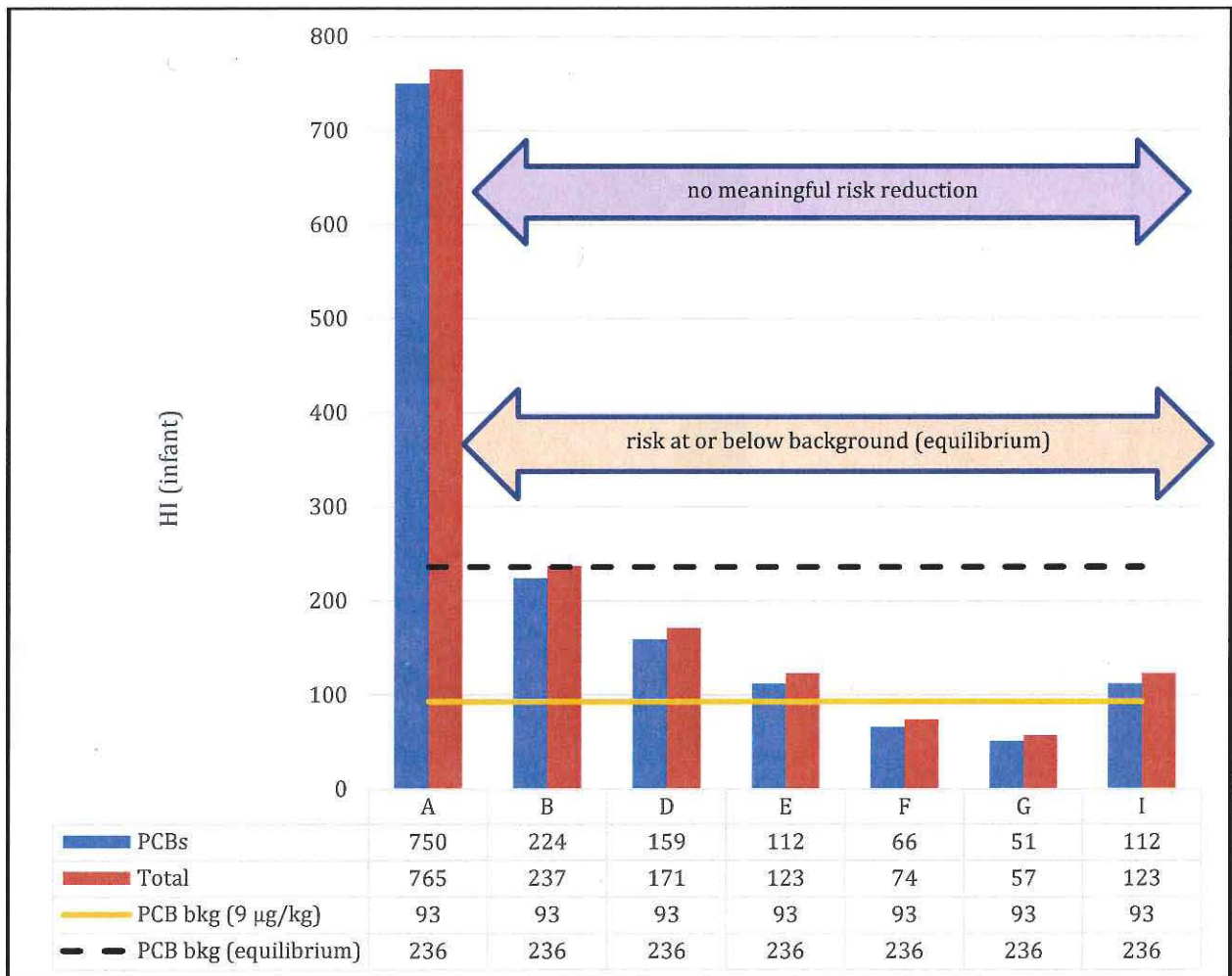


Table J1-2 of the FS shows that residual risks, at the RAO 2 PRGs, range from 3×10^{-5} to 8×10^{-5} for sitewide and RM/SDU, respectively. These are driven primarily by PCBs and dioxins/furans at background levels. The hazard indexes for the infant range from 45 to 132 and for the child range from 2 to 6, which are also driven by background levels of PCBs and dioxins/furans.

Smallmouth bass upstream of Portland Harbor have a whole body PCB concentration of 238 $\mu\text{g}/\text{kg}$ on average⁵¹, and applying the whole body-to-fillet ratio from the BHHRA of 0.16 provides a fillet concentration for upstream fish of 38 $\mu\text{g}/\text{kg}$. The tissue PRG from the Proposed Plan is 0.25 $\mu\text{g}/\text{kg}$. Yet, a PRG based on the sediment background concentration of 9 $\mu\text{g}/\text{kg}$ would result in a modeled tissue concentration of 23 $\mu\text{g}/\text{kg}$. How can EPA propose a PRG in fish tissue that is two orders of magnitude lower than what it says can be achieved even with its highly speculative and unlikely PCB background-based PRG? Moreover, looking at more realistic background values, the estimated equilibrium value of 20 $\mu\text{g}/\text{kg}$ for PCBs would result in a fish tissue concentration of approximately 50 $\mu\text{g}/\text{kg}$, which is in the range of upstream fish tissue concentrations and corresponds to approximately 1×10^{-4} risk (Table B3-5 of FS). If current fish tissue concentrations are closer to 100 $\mu\text{g}/\text{kg}$ (on a fillet basis), only a 2- or 3-fold decrease in sediment concentrations sitewide is warranted to reach equilibrium conditions. The current PCB PRG of 9 $\mu\text{g}/\text{kg}$ represents a more than 20-fold decrease from EPA's sitewide SWAC (although this value may be overestimated, based on sampling conducted in 2014). A more achievable PRG for PCBs might be in the range of 100 $\mu\text{g}/\text{kg}$. But this type of analysis and risk management decision-making was not provided in the FS or Proposed Plan.

EPA also should have considered modifying exposure assumptions in setting PRGs instead of continuing to utilize upper-bound fish consumption rates of 142 g/day and 49 g/day for the subsistence and recreational fishers, respectively, even though no remedies can meet a 10^{-6} risk level due to background and upstream. Instead EPA continues to set the expectation that fish in Portland Harbor can be ingested at these high rates, which is misleading to the public since these rates of fish ingestion will never result in acceptable risks, regardless of the degree of cleanup in Portland Harbor due to upstream conditions that include an ongoing fish advisory for mercury.

Much of the risk is also driven by scant dioxin/furan data which is treated in the total risk calculations with as much certainty as the more robust PCB data sets (though the PCB datasets are old, and the methods of interpolation include a high level of uncertainty).

⁵¹ Described in Section 4.3 of this letter.

8 REMEDY DEVELOPMENT AND IMPLEMENTABILITY ISSUES

The LWG, in its comments on the Proposed Plan, has identified many issues with the remedy development and implementation that make portions of the remedy technically impracticable (e.g., sheet pile walls in deep water and in areas with shallow bedrock), more costly (e.g., waste handling approach that will be difficult to implement and cause delays) and necessitate longer implementation timeframes (e.g., assumed dredge production rates are unrealistic including working around vessel traffic in the navigation channel and broadly constructed sheet pile barriers or silt curtains). In addition, the FS understates the implications of dredge releases on construction risk and the impacts of best management practices to minimize dredge releases on production rates and cost. Appendix O fails to provide a quantitative, or qualitative, evaluation of the relative degree of dredge releases associated with each alternative. This appendix draws poorly supported conclusions on issues having significant implications to the implementability and cost of the Preferred Alternative, based on a very superficial discussion of the processes contributing to dredge releases. Key examples are the requirement that a 12-inch layer of sand cover over all dredged areas, and the assumption that a sheet pile containment will provide appreciable benefit to water quality relative to enormous implementability and efficiency challenges and cost. This appendix is actually not referenced in the text and Table 4.3-1 does not even mention dredge residuals in its analysis. EVRAZ incorporates these LWG comments by reference.

9 THE COMPARATIVE ANALYSIS OF ALTERNATIVES AND SELECTION OF PREFERRED REMEDY IS NOT SUPPORTED.

The flawed assumptions, arbitrary and capricious decisions, and poor science/engineering identified in the sections above are used to support EPA's selection of Alternative I through the comparative analysis of alternatives in the EPA draft Final FS. As discussed above, Alternative I, the Preferred Alternative will not provide meaningful additional benefit over the alternatives with smaller footprints. The various flawed, unsupported and arbitrary analyses in EPA's FS (noted throughout this document) need to be addressed prior to completing a rigorous cost effectiveness evaluation. A cost-effectiveness analysis based on the true project costs and benefits will demonstrate that the cost of the EPA proposed remedy is disproportionate to the benefits and that a similar or greater cost effectiveness can be achieved through Alternative B. Given that Alternatives B and D (as well as C) meet criteria and are more cost effective than Alternative I, EPA should either choose the lower cost alternative (Alternative B) or fix the flawed, poorly documented and inconsistent analyses in the FS in order to support a technically defensible and well documented cost-effective remedy decision. Through a similar analysis, Alternative B-i from the LWG FS is expected to be cost-effective, quickly implementable, result in a cleaner river much more quickly than other alternatives put forth by EPA, and be protective of human health and the environment.

9.1 When Flaws Identified Above are Addressed, the Comparative Analysis will Show that Alternative B is Not Significantly Different than Alternative I.

The Proposed Plan relies on the EPA FS comparative analysis of alternatives (Section 4, Table 4.3-1) to identify Alternative I as the Preferred Alternative. Table A provides this comparative analysis of alternatives with a focus on Alternatives B and I and includes EVRAZ's opinion on the significance of each criteria. The uncertainties and irregularities of the EPA FS and Proposed Plan yield a preferred remedy that hinges on a set of faulty assumptions and analyses, and thus, a high level of uncertainty in the incremental benefits Alternative I provides relative to Alternative B. As discussed in Sections 3 and 7, many of the PRGs are flawed and RAOs based on surface water, groundwater and riverbanks are not appropriate. In addition, the benthic risk analysis using the EPA FS approach is flawed.

The SWACs presented in the Proposed Plan as the basis for decision making (they are the foundation upon which the risks are calculated) are very uncertain. By EPA's admission in Appendix I, the starting sitewide SWACs for total PCBs can range from 79 to 205 $\mu\text{g}/\text{kg}$ a 2.6-fold difference. Yet Appendix J uses a starting sitewide SWAC for PCBs of 208 $\mu\text{g}/\text{kg}$. This 208 $\mu\text{g}/\text{kg}$ SWAC is presumed to be related to a method for calculating a 95% upper confidence limit on the mean (on the sitewide average) that erroneously gives equal weight to each SDU (although their sizes vary). Despite the 2.6-fold difference in calculated sitewide SWACs, 2 to 2.5-fold differences in the risk reduction among the remedial alternatives are used to support selection of the preferred remedy. The post-construction SWACs are also dependent upon the replacement value used to estimate construction benefits, and the value of zero used in the FS does not accurately reflect post-construction conditions. This optimistically assumes no appreciable influence of dredge residuals or upstream inputs on chemical concentrations of backfill or cap materials. The uncertainty impacts all the estimates, but the degree of overestimating is higher for the remedies with less removal because of the use of the zero replacement values and the lack of incorporation of MNR. The uncertainty associated with the starting and post-construction SWACs is compounded by the issues with the modeled tissue concentrations and resulting risk, and the estimation of residual risk for river miles and SDUs, where the food web and exposure scenarios are not applied on an appropriate scale. Finally risks are exaggerated for PCBs by division by a value less than background as discussed in Section 7.3.

The uncertainty with the calculated SWACs and residual risks associated with Alternatives B and D, as well as improper development of surface water PRGs has led EPA to determine that these alternatives do not meet the threshold criterion for protectiveness and compliance with ARARs. However, EPA bases this assertion on protectiveness on wide overlapping error bars being the basis for Alternatives B and D being statistically indistinguishable from Alternative A. This use of the error bars is incorrect. As indicated in the EPA draft FS (August 2015), and the inclusion of Alternative B and D in the

comparative analysis, these alternatives should be retained and considered for implementation.

EPA's post-construction risk as a metric ignores the meaningful effect of natural recovery on improving sediment conditions since the RI sampling, during remedial design and remedial action and post-remedial action. It also ignores improvements associated with *in situ* treatment and ENR during and immediately post-construction. And EPA has not used more recent data including fish tissue data collected by the LWG in cooperation with EPA and additional sediment data collected by interested parties using EPA protocols. Both of these data sets show recovery. EPA's refusal to use this data suggests it is biased toward larger remedies afraid that incorporated of the new data will show that a less aggressive alternative is appropriate.

With regard to cost, as indicated in the introduction, several firms with experience at similar sites have evaluated the costs provided by EPA and all reached a similar conclusion that EPA's estimated remedial costs are under-predicted by approximately 50 percent (AECOM 2016). This means that the high-end undiscounted cost presented by EPA should actually be the point estimate, with an uncertainty of -30%, +50% applied to the higher cost. One of the cost estimates was completed by Integral Consulting on behalf of EVRAZ. Integral has experience in implementing and costing state and federal sediment cleanups as well as in preparing feasibility studies to evaluate the EPA costs presented in the FS and Proposed Plan. This analysis (Attachment 1) revealed considerable uncertainty regarding the cost of EPA's proposed remedy due to a general lack of transparency in the FS (e.g., outcomes of technology flow charts are not mapped, basis for waste designation and treatment is nebulous, the assumptions and costs for sediment and decant water handling, processing, transloading, and hauling are incomplete and underestimated). It found that the level of detail, accuracy, and documentation of EPA's estimate for the Proposed Plan (Alternative I) is not consistent with FS costing guidance, the standard of practice required of FS estimates for similar CERCLA sites, or recent project experience. The unrealistic projection of the overall range of potential cleanup costs provides an insufficient basis for comparison of the alternatives or selection of a preferred remedy.

Finally, EVRAZ believes it is inappropriate for EPA to present its costs with a 7% discount factor. While, the EPA costing guidance, which was issued in 2000, recommends use of the 7% discount rate when preparing cost estimates during remedy selection, the guidance recognizes that there are circumstances when a discount rate lower than 7% is appropriate (USEPA 2000). The current Federal Office of Management and Budget (OMB) values have been appropriately used at other CERCLA sediment sites in the last 3 years including the Lower Duwamish Waterway (AECOM 2012). The current OMB value is 1.5%. The implication by EPA's assumptions that performing parties could yield a net of 7% on investments is capricious.

The analysis in Table A shows Alternative B has a favorable outcome relative to Alternative I. The difference in long term risk between Alternative I and Alternative B is not significant and does not justify a more costly remedy that will have more community and environmental impacts. With both Alternative B and I, the amount of fish someone could eat from the river long term under either remedy is very low with the difference between alternatives on the order of 4 ounces a month, as described in Section 7.4. Any limited increase in risk reduction does not warrant the additional implementation risk and cost.

9.2 EPA Fails to Demonstrate that the Preferred Alternative Satisfies the Statutory Requirements of the NCP for Cost-Effectiveness.

The NCP states that remedial alternatives shall not be selected if other alternatives provide an equivalent level of protection at a lower cost⁵². However, the Proposed Plan and FS lack an adequately rigorous and quantitative cost-benefit analysis across the alternatives to determine whether this is the case. Such an assessment is warranted of any large, complex project expected to cost over \$1 billion dollars.


EVRAZ performed a preliminary cost effectiveness analysis taking into consideration our understanding of the EPA's remedial alternatives and their likely performance as measured by the five NCP balancing criteria (long-term effectiveness, short-term effectiveness, reduction in toxicity, implementability, and cost). The following sections present the basis for conducting the analysis and discussion of results.

9.2.1 Background

For large scale and complex sediment cleanup such as Portland Harbor, and consistent with the NCP, an evaluation of the relative benefits and costs of remedial alternatives is required to ensure that the selected remedy is cost-effective relative to competing alternatives. A range of sufficiently rigorous and quantitative tools exist to facilitate this evaluation, which can provide important and defensible information to support the remedy selection process. One common method used to assess cost-effectiveness is the MODA (Linkov et al. 2004; Huang et al. 2011; Linkov and Moberg 2012). MODA (also referred to as multi-criteria decision analysis, MCDA) provides a framework for addressing challenging decisions involving multiple objectives, large-scale complex alternatives, numerous sources of uncertainty, and significant consequences. MODAs are commonly used by federal agencies to address complex public projects and over the past 20 years have increasingly been applied to environmental projects, including large-scale CERCLA sediment cleanups (AECOM 2012; Linkov et al. 2006).

Application of a MODA-type tool would address a significant weakness of EPA's draft final FS and /Proposed Plan—that is, the failure to rigorously and quantitatively to consider or communicate the totality of the benefits and consequences associated with the FS

⁵² 40CFR300.430




remedial alternatives. The comparative analysis of alternatives presented in the draft final FS does not address the full scope of tradeoffs that occur between the alternatives. After revising the draft final FS/Proposed Plan to address technical concerns, a MODA-type approach would provide a framework to focus on the big picture and incorporate the results of many analytical approaches and decision metrics. One logical metric that has been used for MODA analyses at other CERCLA sites is the NCP remedy evaluation balancing criteria (long-term effectiveness, reduction in toxicity, short-term effectiveness, implementability, and cost).

9.2.2 Cost Effectiveness Evaluation of FS Alternatives

To demonstrate the utility of this type of evaluation, a simplified MODA was performed for the remedial alternatives presented in EPA's draft final FS. The analysis involved ranking each of the 5 NCP balancing criteria, taking into consideration the associated evaluation sub-metrics for each of the balancing criteria, as defined in the CERCLA guidance. These criteria and metrics are summarized in Table 9-1 (reproduced from EPA'S draft final FS).

Table 9-1. Summary of NCP Remedy Evaluation Criteria for Remedy Selection and MODA/Cost-Effectiveness Determination

NCP Evaluation Criteria	Typical Evaluation Metrics
Threshold Criteria	
Overall Protectiveness	<ul style="list-style-type: none"> • Human Health <ul style="list-style-type: none"> ○ Incidental ingestion of and dermal contact (RAO 1) ○ Consumption fish/shellfish (RAO 2) ○ Direct contact surface water (RAO 3) ○ Migration groundwater to sediment/surface water (RAO 4) • Environment <ul style="list-style-type: none"> ○ Benthic organisms (RAO 5) ○ Consumption of Prey (RAO 6) ○ Direct contact surface water (RAO 7) ○ Migration groundwater to sediment/surface water (RAO 8) ○ Migration river banks (RAO 9)
Compliance with ARARs	<ul style="list-style-type: none"> • Chemical-specific ARARs • Location-specific ARARs • Action-specific ARARs
Balancing Criteria	
Long-Term Effectiveness And Permanence	<ul style="list-style-type: none"> • Magnitude of Residual Risks • Compliance with RAOs (as listed above) • Adequacy and Reliability of Controls
Reduction Of Toxicity, Mobility Or Volume Through Treatment	<ul style="list-style-type: none"> • Treatment Process Used and Material Treated • Amount Destroyed or Treated • Reduction in Toxicity, Mobility, or Volume • Irreversible Treatment • Type and Quantity of Residuals Remaining after Treatment
Short-Term Effectiveness	<ul style="list-style-type: none"> • Community Protection • Worker Protection • Environmental Impacts • Time Until Action is Complete (RAOs Achieved)
Implementability	<ul style="list-style-type: none"> • Ability to Construct and Operate • Ease of Doing More Action, if Needed • Ability to Monitor Effectiveness • Ability to Obtain Approvals and Coordinate with Other Agencies • Availability of Specialists, Equipment and Materials • Availability of Technologies
Cost	<ul style="list-style-type: none"> • Total Net Present Value of Alternative



The MODA process typically involves further refinements including, 1) assigning rankings to the NCP balancing criteria and sub-metrics, and 2) weighting each of the metrics to represent judgment of their relative importance (Linkov et al. 2004; Huang et al. 2011; Linkov and Moberg 2012). Given the outstanding concerns and uncertainties in EPA's FS, the analysis presented herein does not attempt this level of quantitative refinement. Rather, a simplified approach is used to illustrate the benefits of a balanced and transparent approach to assess the key remedy selection criteria. A more refined analysis should be performed for the final remedial alternatives, upon resolution of the technical concerns and comments identified in this letter.

EPA's FS states that Alternatives B and D do not satisfy the threshold criteria; nevertheless, EPA presents its version of the balancing criteria evaluation for Alternatives B and D. The EPA's assessment of the NCP threshold criteria for Alternatives B and D is flawed and, with appropriate and technically defensible FS assumptions and supporting analyses, all of the remedial alternatives, except the no-action alternative (Alternative A), satisfy the NCP threshold criteria. Notably, Alternatives B and D would be at least as protective as Alternative I. The flaws associated with EPA's calculation of the post-construction risk associated with each remedial alternative were described in Section 7.

9.2.3 Discussion of Results

Table 9-2 presents the results of the simplified MODA conducted for the remedial alternatives. The analysis ranks each of the 5 NCP balancing criteria for each alternative from 1 to 5, representing the performance of the alternative relative to both the evaluation metrics and the other remedial alternatives. A score of 5 is reserved for alternatives that meet or exceed all evaluation metrics and exceed the performance of all other alternatives by a notable margin. A score of 1 is reserved for alternatives that rank poorly relative to the metric and the other alternatives. The analysis included qualitative assessment of the sub-metrics (Table 9-1) of each NCP balancing criterion. A brief summary of key ranking considerations for each of the balancing criteria is presented in the right column of Table 9-2.

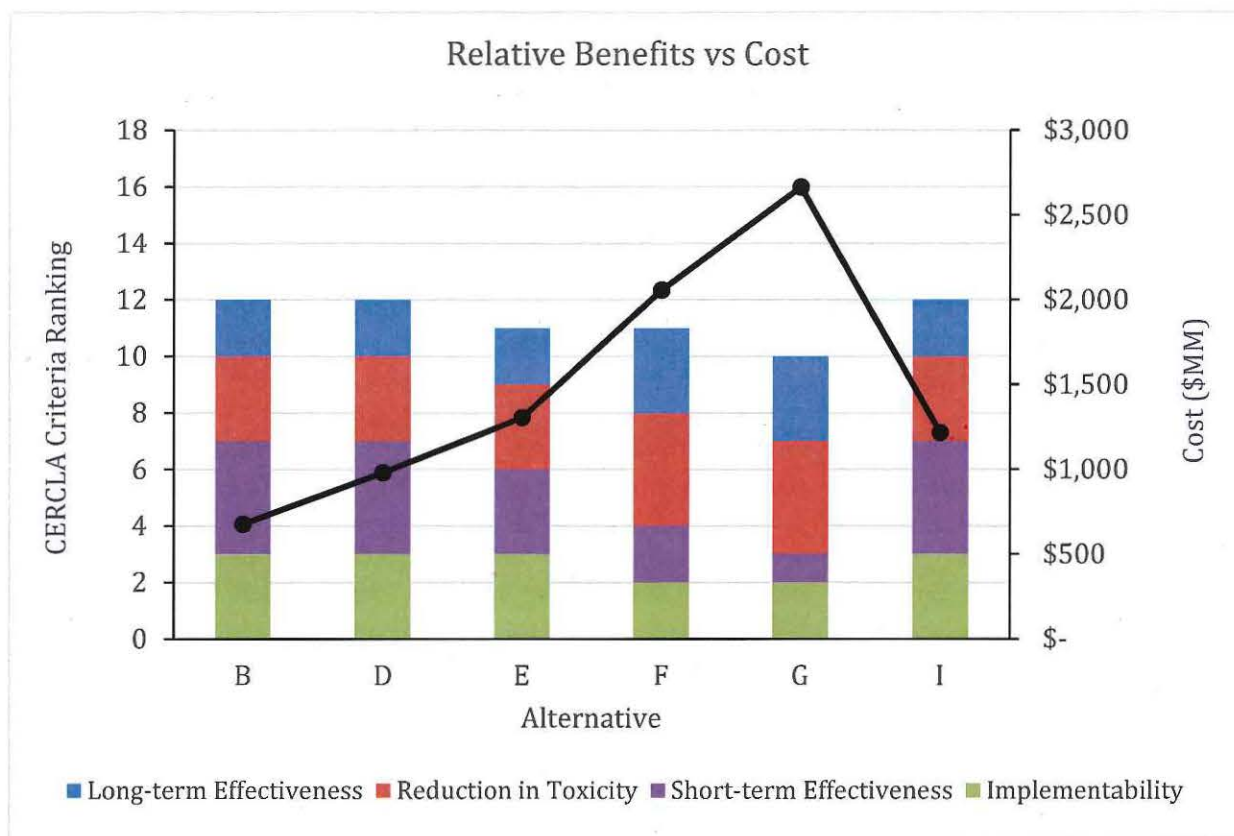
Table 9-2. Tabular Summary of NCP Criteria Ranking for EPA FS Remedial Alternatives

NCP Balancing Criteria	EPA Draft Final FS Alternatives							General Evaluation Considerations
	A-No Action	B	D	E	F	G	I	
Balancing Criteria								
Long-term Effectiveness	na	2	2	2	3	3	2	As currently defined, no alternative achieves all RAOs. Basis for Interim risk calculations and resulting values are highly uncertain. FS lacks technically defensible projection of long-term performance.
Reduction in Toxicity	na	3	3	3	4	4	3	Assume <i>ex situ</i> treatment volume is primary sub-criterion (same for all alternatives. Degree of reduction in toxicity due to <i>in situ</i> treatment (represented in the FS by broadcast GAC, reactive caps, and reactive residual cover layer) is highly uncertain, as currently defined and evaluated in the FS. Basis/benefits for treating PTW is nebulous and not applicable.
Short-term Effectiveness	na	4	4	3	2	1	4	Assume short-term effectiveness is driven equally by the combined dredge and backfill volume (rather than years, given uncertainty in EPA's construction durations), and time to achieve RAOs (which is "uncertain" for all Alts, as stated by EPA).
Implementability	na	3	3	3	2	2	3	Assume implementability of all alternatives is uncertain given flaws and uncertainties in the basis, technical feasibility, and performance of the technology assignments for EPA's FS alternatives (e.g., broadcast GAC, sheetpile containment, containment, removal, coordination of dredging equipment with harbor

	EPA Draft Final FS Alternatives							
NCP Balancing Criteria	A-No Action	B	D	E	F	G	I	General Evaluation Considerations
Balancing Criteria								
								traffic). Larger removal alternatives and alternatives requiring sheet pile cofferdams and <i>in situ</i> treatment will have inherently greater implementability challenges.
Cumulative Ranking	na	12	12	11	11	10	12	
Cost (\$Millions) - NPV	na	\$677	\$981	\$1,305	\$2,057	\$2,666	\$1,217	EPA costs increased by factor of 1.5 based on independent estimates conducted by 4 nationally recognized environmental consulting firms specializing in remediation of contaminated sediments.

The results of the analysis are also presented in graphical format on Figure 9-1, which provides a means to compare the relative overall benefits and costs of the remedial alternatives. The cumulative benefits are presented in the form of a stacked bar chart for each alternative, representing the four performance-related NCP balancing criteria. The final balancing criteria, cost, is presented as an overlay on the bar chart to facilitate a relative comparison of the incremental benefits and costs for each alternative.

Figure 9-1. Comparison of Relative Benefits and Costs for Draft Final FS Alternatives



Alternatives B, D, and I ranked the highest (best), and equally, with respect to their overall combined benefits, with estimated remedial costs ranging from \$680M TO \$1,217M. Alternative E, F, and G ranked slightly lower than Alternatives B, D, and I, and have higher estimated costs (\$1,305M to \$2,666M).⁵³ As indicated in Figure 9-1, there is little to no discernable difference in the relative benefits among the alternatives, while the

⁵³ Figure IV-2.

incremental costs of the larger removal alternatives are disproportionately large relative to the benefits.

The findings presented herein represent a reasonable preliminary cost-effectiveness assessment of EPA's remedial alternatives using a simplified MODA approach. This analysis is based on information presented in the EPA draft Final FS (that is in some cases flawed and in other cases lacks transparency) and best professional judgment; different outcomes may occur if performed by different parties. Several of the alternatives perform similarly with regard to benefits. Therefore, cost should be an important consideration and a potential key differentiating factor in the remedy selection process.

9.2.4 Conclusions

Based on this analysis, the incremental costs of Alternatives E through I are disproportionately high, considering that there is little to no ascertainable incremental benefit associated with the more intensive alternatives. Consistent with the statutory requirements of the NCP, this disproportionate relationship should be considered in the remedy selection process and cost-effectiveness determination. Alternatives that do not offer significant improvements in protection relative to less costly alternatives should be eliminated. EPA should reconsider the deletion of Alternative C from the analysis and select Alternative B which provides similar benefits for a lower cost consistent with the cost-effectiveness requirements of the NCP.

When the flaws identified above are addressed, the comparative analysis will show that EPA has not comprehensively evaluated the sustainability of the alternatives for Portland Harbor. EPA has not integrated environmental, economic, and social considerations. We urge EPA to use a sustainability framework during the remedy selection process to support informed decisions that considers stakeholder values. The Portland Harbor Sustainability Project (AECOM et al. 2016), where a more quantitative analysis similar to the MODA described above was independently completed with similar results, is one such framework that EPA should consider in remedy selection. Three separate analyses—environmental, economic, and social—were completed. All three reports are quantitative and conclude that Alternative B provides the most sustainable balance of impacts, benefits, and trade-offs valued by stakeholders. EPA's current decision analysis process does not consider the carbon footprint of the relative alternatives (AECOM 2016). The economic losses (net job and gross regional product [GRP] losses) resulting from remediation expenditures are expected for all remedial alternatives; the extent of losses should be weighed against the gains from risk reduction and redevelopment opportunities (NERA 2016). As an example of these quantitative analyses, Table 9-3 illustrates the range of environmental impacts for several key metrics, for Alternatives B, I, and F. As indicated, the environmental impacts associated with Alternative I are roughly 2 to 3 times greater than Alternative B for each of these metrics.

Table 9-3. Key Environmental Metrics for EPA FS Remedial Alternatives

Environmental Metrics	Alternative		
	B	I	F
GHG Emissions (Metric Tons)	345,770	613,846	1,046,430
Ecological Footprint/Forest Sequestration (Acres)	37	66	112
Landfill Usage (Tons)	1,305,455	2,893,454	7,508,152
Truck Trips (# Round Trips @ 280 Miles)	52,642	144,673	375,408

Source: AECOM 2016

EPA should also consider the economic implications of its decision to the Portland regional area. The economic analysis (NERA 2016) evaluates both the benefits and costs of Alternative I on the regional economy and conservatively estimates that Alternative I will result in an additional average annual job loss of between 120 and 300 jobs and an average annual gross regional product loss of \$18 to \$44 million.⁵⁴

10 THE PROPOSED PLAN IS ARBITRARY AND CAPRICIOUS AND OTHERWISE NOT IN ACCORDANCE WITH LAW IN ITS CURRENT FORM AND NEEDS TO BE REMEDIED BEFORE THE ROD IS ISSUED OR THE ROD ITSELF WILL BE ARBITRARY AND CAPRICIOUS AND OTHERWISE NOT IN ACCORDANCE WITH LAW.

Based on the deficiencies outlined in this letter, EVRAZ believes that a more rigorous, scientifically sound, and technically feasible evaluation is required for the ROD to be defensible and not arbitrary and capricious. This analysis must be reworked and all evidence taken into account *before* a ROD is issued so that the cornerstone decision document—the ROD—that will guide remedial action and decision making for decades to come in Portland Harbor is *correct from the get-go*.

⁵⁴ The analysis is considered conservative because it estimates construction jobs will come from within the region. However, dredging and contaminated sediment management contractors are specialized, and much of the work force will come from outside the region.

The Proposed Plan does not provide a clear remedy or sufficient technical reasoning to be assured that implementation will be possible and quickly achievable following the ROD. The Proposed Plan, as it is issued, appears to be a quickly gathered document with missing technical justification in many areas and incorrect conclusions in others.

EPA's Proposed Plan is based on assumptions and analysis that are not supported by technical analysis, good science, or EPA policy and guidance. The NCP requires that the remedy EPA selects be supported by the RI/FS, and that the Proposed Plan describe the information relied on to select the preferred alternative so that the public has an opportunity to provide meaningful comment 40 CFR 300.430(F)(2). The Proposed Plan violates the NCP because it reaches conclusions that are not supported by the technical information contained in either the Proposed Plan itself or EPA's FS. It is arbitrary and capricious, and does not comply with fundamental legal requirements.

"To show that the government's response action is inconsistent with the NCP, a defendant must demonstrate that the [agency] acted arbitrarily and capriciously in choosing a particular response action." *In re Bell Petroleum Services*, 3 F.3d 889, 907 (5th Cir. 1993) (quoting *U.S. v. Hardage*, 982 F.3d 1436, 1442 (10th Cir. 1992)). An action is arbitrary and capricious if the agency

has relied on factors which Congress has not intended it to consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise.

Motor Vehicle Mfrs. Ass'n of U.S., Inc. v. State Farm Mut. Auto. Ins. Co., 463 U.S. 29, 43 (1983). When rendering its decision, the agency must "examine the relevant data and articulate a satisfactory explanation for its action including a 'rational connection between the facts found and the choice made.'" *State Farm*, 463 U.S. at 43 (quoting *Burlington Truck Lines v. United States*, 371 U.S. 156, 168 (1962)). A reviewing court must "consider whether the decision was based on a consideration of the relevant factors and whether there has been a clear error of judgment." *Id.* (quoting *Bowman Transp. Inc. v. Arkansas-Best Freight System*, 419 U.S. 281, 285 (1974)).

Proposed plans are arbitrary and capricious where, as here, they fail to comply with fundamental requirements imposed by the NCP. For example, an agency action is arbitrary and capricious where it fails to "determine the nature or the extent of the threat posed"; evaluate alternatives against based on cost, acceptable engineering practices, and projected effectiveness; or re-evaluate alternatives after discovery of additional contamination. *Wash. State Dept. of Transp. v. Wash. Nat. Gas. Co., PacifiCorp*, 59 F.3d 793, 802 (9th Cir. 1995). In *PacifiCorp*, the court found "no difficulty" finding the agency's

action arbitrary and capricious “[g]iven the high degree of inconsistency with the requirements set forth in the NCP.” *Id.* at 805.

Simply reciting NCP requirements, or asserting without support that an agency action complies with the NCP requirements, is not enough. See *W.R. Grace & Co. v. U.S.*, 261 F.3d 330, 340 n.3 (3d Cir. 2001) (cautioning agency against reciting “magic words” in support of decision without providing “any support in the record to demonstrate that the finding is not arbitrary and capricious”). Where the facts show that an agency action is based on insufficient, stale, or nonexistent data, it violates the NCP. See, e.g., *Matter of Bell Petroleum Svcs., Inc.*, 3 F.3d 889, 905 (5th Cir. 1993) (agency action arbitrary and capricious where selected remedy unsupported by data); *State of Minn. v. Kalman W. Abrams Metals, Inc.*, 155 F.3d 1019, 1025 (8th Cir. 1998) (agency action arbitrary and capricious where agency selected unproven remedy and failed to adequately study nature or extent of contamination); *U.S. v. Jones*, 267 F. Supp. 2d 1349, 1364 (M.D. Ga. 2003) (failure to determine extent and nature of pollution or develop remedial alternatives could be sufficient to meet arbitrary and capricious standard).

The Proposed Plan should be correct, transparent, and fully supported by technical analysis and good science in order to avoid a ROD that could be subject to significant legal challenge, delaying remedy implementation for decades to come.

The Portland Harbor Proposed Plan is based on substantial misstatements of the true hazards to human health and the environment that are posed by the contamination in river sediments. EPA has not been candid in its communication of the risks associated with the site. As a result, the Proposed Plan is misleading in implying that Alternative I will produce risk reductions materially greater than Alternatives B, C, and D.

EPA has justified the Proposed Plan by reference to outdated and inadequate data. Due in large part to aggressive source control, the environmental conditions in the river have improved considerably since investigation was commenced in the early 2000s both as a result of remedial actions and natural processes. This improvement has not been adequately considered by EPA, or appropriately factored into EPA’s planning. An agency decision will be overturned by the court if the agency “entirely failed to consider an important aspect of the problem, or offered an explanation that runs counter to the evidence before the agency” *Greater Yellowstone Coalition v. Lewis*, 628 F.3d 1143, 1148 (9th Cir. 2010). The Proposed Plan is arbitrary and capricious under this standard in many ways, including the following examples, as outlined in this letter:

- EPA’s goals and objectives are arbitrary and capricious because they do not follow guidance, the NCP, or established ARARs.
- EPA’s description of current site conditions is arbitrary and capricious because it fails to take into account known data, site conditions, appropriate background considerations, and ongoing, improving natural recovery conditions.

- In addition, EPA arbitrarily identified riverbanks as contaminated without addressing data, cleanup actions that have already occurred, or delineating where contamination actually begins and ends. Where riverbanks were identified as contaminated, the entire shoreline of that particular property was mapped as “contaminated”, such that property boundaries instead of data drove the delineation. Various remediation lengths and excavation and capping material volumes differing by remedial alternative were reported on a sitewide basis. Based on limited explanation in the FS, it appears that the portion of the riverbank requiring remediation for each alternative was that part of the mapped “contaminated” riverbank lying adjacent to sediment areas exceeding the RALs. However, the maps showing active remediation footprints for each remedial alternative do not show different riverbank extents by alternative; so it is unclear to the reader which shoreline areas are assumed to be remediated under each remedial alternative. Riverbank excavation and backfill volumes were found from assumed lengths of riverbanks requiring remediation and generic assumptions about excavation depth and slope geometry. These generic assumptions were applied sitewide with no consideration of actual bank conditions.
- EPA’s development and establishment of RALs for the site are arbitrary and capricious because they are overly prescriptive and do not take into account current data, site conditions present at the time of construction, or technically appropriate approaches to cleanup in a dynamic river system. EPA should revisit the RALs to allow for technical flexibility and considerations for site specific conditions.
- EPA’s Proposed Plan arbitrarily establishes different levels of cleanup for different sections of the Site. As best illustrated in Proposed Plan Figure 9 and Proposed Plan Table 13, EPA is recommending a remedial alternative that results in cleanup to different Remedial Action Levels in different portions of the site. For example, in those areas where cleanup will be to the “Alt D RAL,” PCBs will be remediated to the level of 500 µg/kg, but in those areas designated by the “Alt E RAL,” they will be remediated to 200 µg/kg. Given that this appears to be evaluated on a rolling river mile risk exposure area (see, e.g. App. J to the FS), there appears to be no technically or legally defensible basis for saying that 500 µg/kg PCBs is protective in some areas but not others. If 500 µg/kg can be protective, then that should be the PCB RAL sitewide.
- Similarly, in those areas designated as being cleaned up to the “Alt B + PTW RAL,” the action level for total PAHs will be 170,000 µg/kg. If that is acceptable in those areas, it should be acceptable in others and should be adopted as the sitewide tPAH RAL. If any Alternative B or Alternative D RAL is acceptable anywhere in the site, it should be accepted everywhere. Evraz believes this is accomplished and justified by choosing Alternative B RALs through the site.
- It is particularly arbitrary to adopt different RALs when there are large areas of the site for which we do not have significant amounts of data (e.g. dioxins/furans).

There is no justification for these different cleanup levels, and EPA is not able to adequately cost cleanup for these substances since there is not enough data to know what localized concentrations are.

- EPA arbitrarily employed differing methods to calculate SWACs, for different analyses and did not document methods used to develop SWACs. This resulted in decisions based on SWACs that are highly suspect at best and therefore arbitrary and capricious.
- Additionally, at least one of the PRPs has conducted its own more recent data gathering effort that supports natural recovery at the Site, and EPA has refused to incorporate that data into the record (Kleinfelder 2015; Schnitzer Steel et al. 2015).
- In addition to EPA's reliance on outdated and inadequate data, EPA's failure to adequately address cost effectiveness of the Proposed Plan is arbitrary and capricious. At least one court has determined that "to be consistent with the NCP, all remedial actions must be "cost-effective." Franklin County Convention Facilities Auth. v. American Premier Underwriters, Inc., 240 F.3d 534, 546 (6th Cir. Ohio 2001). And that "[c]ost-effectiveness is determined by comparing overall effectiveness to cost." *Id.* EPA is required by the NCP to compare the cost effectiveness of the alternatives relative to the impact of the remedy on human health and the environment. 40 CFR 300.430 (e)(9)(iii)(G) (outlining the cost standard) and 40 CFR 300.430 (f)(1)(B) (providing the requirement to balance cost and remedy effectiveness as one of the "Primary Balancing Criteria"). Further, with respect to the primary balancing criteria under the NCP, in order for the chosen remedy to meet the requirements of the NCP, EPA must additionally prove that the remedy is cost effective, which means that EPA must determine if the "overall effectiveness" of the remedy is proportional to all of the costs outlined in 40 CFR 300.430(e)(9)(iii)(G). 40 CFR 300.430 (f)(ii)(D). EPA completely failed to provide a comprehensive assessment of the cost effectiveness of each alternative, failed to compare the cost of each alternative to the effectiveness of the remedy, and failed to compare the cost-effectiveness across the range of alternatives. The court found that a roughly 12% difference in cost between the lower cost alternative and the chosen higher cost alternative was reasonable and "cost-effective." *Franklin County Convention Facilities Auth.*, at 536. In this case, EPA has chosen a remedy that is at least 165%⁵⁵ more than the least cost remedy with no analysis as to the benefit obtained from the significantly increased cost. The lack of a cost benefit analysis is yet one more example of where EPA "entirely failed to consider an important aspect of the problem." *Greater Yellowstone Coalition*, at 1148. This failure is therefore arbitrary and capricious or not otherwise in accordance with law.

⁵⁵ This does not take into account the fact that DMM Scenario 1 will likely not be chosen, which will make the chosen alternative at least 179% more than the least cost alternative, or the fact that EPA's cost estimates are grossly underestimated and the real cost is likely to be at least twice EPA's estimate.

EPA's gross underestimation of the cost of the remedy is arbitrary and capricious because EPA has failed to take into account several costs that EPA knows exist. This failure to follow clear guidance in the NCP and the gross underestimation of the costs—not only on behalf of individual PRPs, but also PRPs that will necessarily pass the cost along to taxpayers and ratepayers—is in itself the definition of capricious agency action.

The Proposed Plan is not adequately justified by the administrative record. The final Feasibility Study does not present a complete and accurate discussion of the bases for EPA's selection of preferred Alternative I. For example, EPA has greatly underestimated both the time it will take to perform the proposed remedy and its cost to implement. EPA also did not consider the sustainability of its proposal when screening/selecting its Preferred Alternative. These are key aspects of an alternatives analysis in the NCP. 40 CFR 300.430 (e)(9). In this case, EPA did not take into account the evidence or the on-site realities that will significantly impact cost, timing, and sustainability of the remedy. An agency's decision may be found arbitrary and capricious if it "offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view of the product of agency expertise." *National Association of Home Builders v. Defenders of Wildlife*, 551 US 664, 658 (2007) (quoting *Motor Vehicle Manufacturers Association v. State Farm Mutual Insurance Company*, 463 US 29, 43 (1983)). If the estimated time and cost of the alternatives are revised to be more accurate, it becomes clear that Alternative I will be far more disruptive to Portland's economy, commerce and neighborhoods than Alternatives B, C, or D with no material gain in risk reduction. EPA's reliance on faulty evidence and failure to take into account available evidence is therefore arbitrary and capricious.

EPA should correct these issues and should not publish the ROD until these problems are corrected. Doing so would result in a ROD that will be subject to challenge when EPA attempts to enforce it, which will further frustrate and delay actual implementation of a remedy. EPA should not issue an arbitrary and capricious ROD.

11 EVRAZ REQUESTED NEXT STEPS

We request that, prior to releasing the ROD, the EPA work with interested parties to complete a more robust comparison of alternatives and cost effectiveness evaluation. This evaluation should include consideration of:

- Current sediment and tissue conditions and associated recovery implications
- Realistic background sediment and surface water concentrations
- Use of risk management principles in considering RGs
- Appropriate application of Oregon Water Quality Standards in considering any surface water target or PRG

- Having riverbank and groundwater source control completed by DEQ. If riverbank and groundwater footprints are considered in the evaluation, they must be based on data and acknowledge actions completed and underway.
- Appropriate methods for calculating SWACs including realistic replacement values that do not overstate improvements
- Refining of the site fate and transport model and using this tool to better assess the magnitude and location of natural recovery and consideration of a reasonable timeframe for recovery
- Appropriate evaluations of post-construction risk and residual risk that are consistent with the approved HHRA and BERA including calculation of risk on an appropriate scale using a FWM or other approach that is calibrated and uses actual background surface water concentrations
- Revised assumptions on specific cost items
- Realistic considerations of implementability related to dredging production rates, sheet pile walls, dredged sediment handling, and the impacts of removing import material from source areas.
- EPA should perform a sustainability analysis and select the most sustainable, cost-effective remedial alternative in the ROD.

EPA should re-screen the various alternatives consistent with corrected risk assessments and assumptions, as described further in these comments, including the full existing data set, and EPA's guidance and practice at other sites. EPA should not rush to issue the ROD simply to meet political goals; rather, analysis in the ROD should be completely technically sound and scientifically defensible.

Finally, when the ROD is issued, the remedy selected should establish broad, governing remedial goals, but should be flexible enough to accommodate the types of remedial design and remedial construction decisions contemplated in the NCP (40 CFR 300.435). For example, Figures 10a–d of the Proposed Plan overstep this line by dictating remedial construction decisions rather than remedial goals and should not be carried forward into the ROD in this form. EVRAZ supports the replacement of these figures with Figure A presented in the LWG's comments on the Proposed Plan and included in this letter. In the alternative, EVRAZ has made several suggested changes to Figures 10a–d, which are included as Attachment 5.

The EPA, as representatives of the federal government, is asking the citizens, local agencies, and industries vested in the future of the City of Portland and the Willamette River, as well as industries with historical ties to Portland, to spend approximately \$1 billion dollars on a cleanup that will not provide the intended benefits (a zero-risk fishery). We believe the true cost will be \$1.8 billion or more. Decisions of this magnitude should

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not be made lightly or with flawed, arbitrary, or unsupported analyses. Further, based on federal EPA and GAO policy and guidance, prudent decision making and planning for complex public projects of this scale dictate the use of industry-standard cost-benefit analytical methods to support the remedy selection process. We request EPA reconsider its evaluation and preferred alternative in the Proposed Plan.

Sincerely,

A handwritten signature in black ink, appearing to read "Patrick Christie", with a long, sweeping horizontal line extending to the right.

Patrick Christie, CSP

Vice President EHS

EVRAZNA

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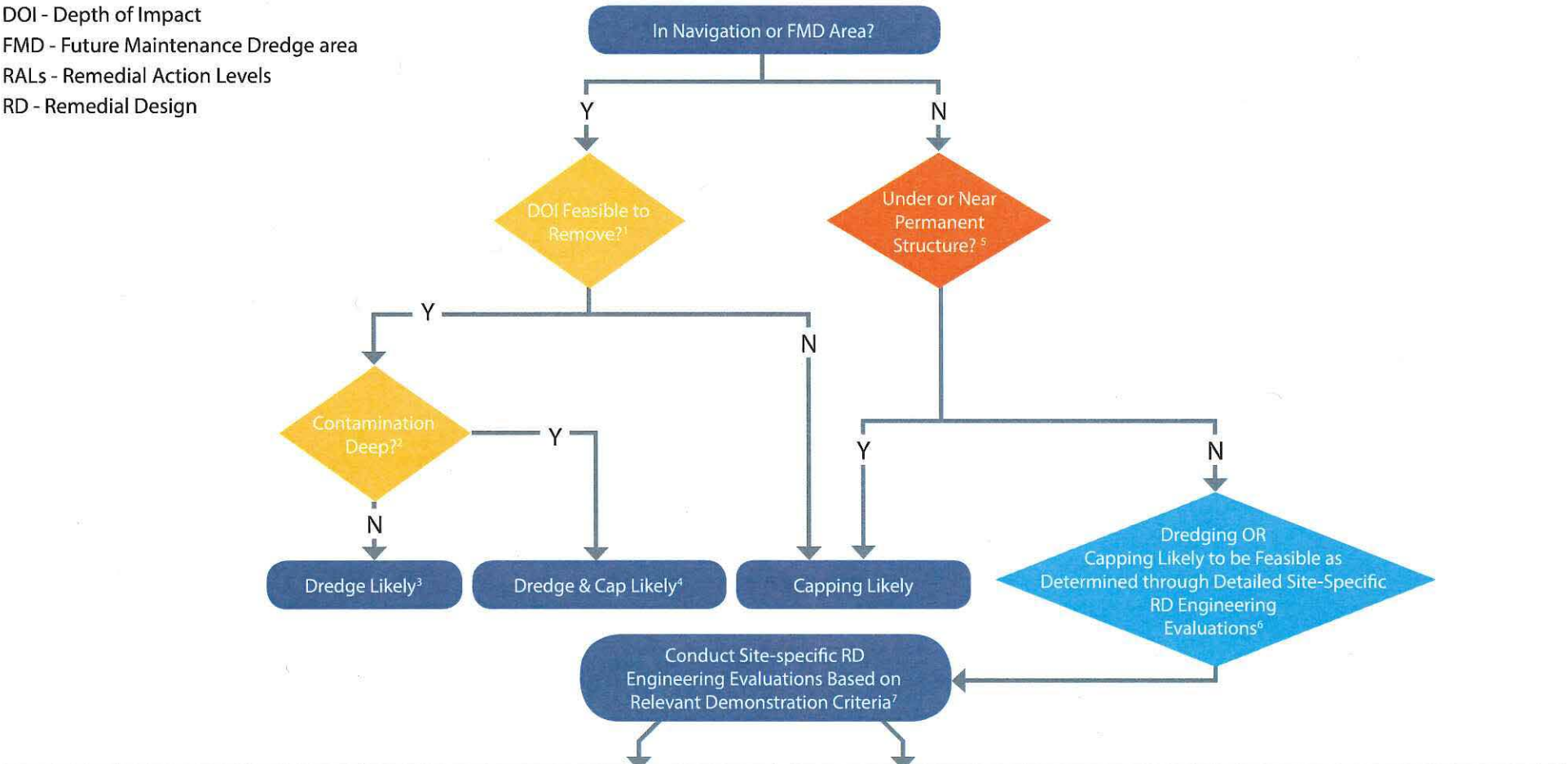
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FIGURE A

**LWG'S PROPOSED TECHNOLOGY
ASSIGNMENT DEMONSTRATION
CRITERIA**

(ATTACHMENT 21 IN LWG'S
COMMENTS ON THE PORTLAND
HARBOR PROPOSED PLAN)

DOI - Depth of Impact
FMD - Future Maintenance Dredge area
RALs - Remedial Action Levels
RD - Remedial Design



Dredging Demonstration Criteria³		Capping Demonstration Criteria⁸	
Erosion	Demonstrate that erosional effects (from currents, propwash, or wind/waves) will not make dredging infeasible due to high sediment resuspension and release conditions. Demonstrate that any necessary dredge residual covers will not be quickly eroded downstream under typical flow conditions.	Demonstrate that the cap will remain in place when subjected to current, wave, and propwash induced forces up to a reasonable design condition (e.g., 50 year flow event for currents).	
Deposition	Demonstrate that further deposition from known or suspected upstream sources and/or dredge residuals from other SDUs will not result in recontamination of the dredge areas.	Demonstrate that further deposition from known or suspected upstream sources and/or dredge residuals from other SDUs will not result in recontamination of the capping areas.	
Shallow/Habitat	Demonstrate that the proposed dredge design will not unnecessarily alter shallow water habitats (or other habitats) in such a way that reduces habitat values (e.g., dredging of shallow areas that converts them to deep water areas). Or alternatively, that dredge habitat impacts are balanced with other remedy features such as: contaminated sediment capping in other areas that increases shallow habitat to the overall remedy, additions of habitat features (e.g., placement of fish mix or other appropriate surface substrates after dredging), compensating on site mitigation, compensating off site mitigation, or other types of habitat impact mitigation.	Demonstrate that the proposed cap design will not unnecessarily alter shallow water habitats (or other habitats) in such a way that reduces habitat values. Or alternatively, that cap habitat impacts are balanced with other remedy features such as: contaminated sediment or riverbank dredging in other areas that increases shallow habitat to the overall remedy, additions of habitat features (e.g., fish mix or other appropriate surface substrates), compensating on site mitigation, compensating off site mitigation, or other types of habitat impact mitigation.	
Steep Slopes/Geotechnical	Demonstrate that the proposed dredge design can be constructed on any steep slopes and will not cause unstable slopes after dredging including adjacent riverbank and upland areas.	Demonstrate that the cap will remain in place on the existing slope through appropriate design evaluations and additional design features (e.g., keying in the cap at the foot of the slope or using more granular material in some layers) as necessary. This should include evaluating seismic events of reasonable design magnitude. Demonstrate that the sediment bed geotechnical properties will adequately support the proposed cap.	
Rock/cobble/bedrock	Demonstrate that the dredging can remove contaminated sediments intermixed with any rock, cobble, or hard substrates (e.g., are speciality or small suction dredges needed?) without substantial exacerbation of dredge resuspension and releases.	Capping of contaminated sediments intermixed with any rock, cobble, or hard substrates can be conducted in most cases because placement of sand or similar material is not affected by the presence of such hard substrates. Erosion demonstration criterion must also be met if hard substrates occur in high energy areas.	
Debris	Demonstrate that debris can be effectively removed to a sufficient degree that any remaining debris will not substantially hinder the efficient removal and subsequent transloading, transport, and processing (e.g., dewatering/treatment) of the removed sediment. Demonstrate that any remaining debris will not contribute to substantially increased sediment resuspension and contaminant releases during dredging.	Demonstrate that the debris does not present a substantial obstruction to effective capping of the area (e.g., such that large voids are not created by overlying timbers or complex debris fields). Or alternatively, that the sufficient debris removal prior to capping is incorporated into the design such that the cap can be effectively placed.	
Flooding	Demonstrate that the proposed dredging plan will not lead to new features (abrupt edges, berms, jutting shoreline features) on the bottom or along the riverbank that could substantially alter river flows such that unacceptable water surface elevation rises are caused locally or otherwise. This can be accomplished through appropriate hydrodynamic modeling if such features are present in the design.	Demonstrate that cap will not cause an unacceptable flood rise in conjunction with the overall remedy for that area. This can be accomplished through balance cut and fill calculations or appropriate hydrodynamic modeling that considers capping and dredging in adjacent or nearby areas.	
Containment	Although dredge residual covers are not intended to “contain” residual contamination, demonstrate that any such covers necessary will be present and available for natural intermixing with surface sediments over a reasonable period of time (i.e., covers will not be quickly eroded downstream under typical flow conditions).	Demonstrate through cap modeling consistent with guidance that the cap design is sufficient to contain and minimize flux of contaminants over a design life consistent with guidance. This would include incorporation of “active” cap features such as organoclay and activated carbon as indicated necessary by modeling runs. The modeling would consider not only the contaminated sediment properties and concentrations but also the presence of any ongoing, stranded, or uncontrolled upland groundwater plumes. The cap design and modeling runs should appropriately incorporate the in-river conditions (good or bad) created by any ongoing or planned upland groundwater source controls.	
DOI	Demonstrate that the DOI can be effectively removed by the dredging equipment proposed while providing stable side slopes. If the DOI can not be completely removed, demonstrate that any remaining contaminated material can be effectively capped by meeting all of the capping demonstration criteria as applied to the new depth horizon created by the proposed dredging.	Any DOI can be capped as long as the other demonstration criteria are met.	

Addressing Principal Threat Waste (PTW) - The LWG has commented for many years that no PTW exists at the Site if the guidance, particularly as it pretains to the “reliably contained” concept, is properly interpreted. In summary, the LWG 2012 draft FS showed through detailed cap modeling calculations that all of the contaminated sediments at the Site can be reliably contained through sufficiently robust capping (i.e., including active cap layers or features in higher concentration areas). Material that can be reliably contained does not meet the definition of PTW regardless of whether it may meet the highly toxic or mobile criteria (i.e., per guidance, the three criteria are evaluated in combination, not	separately). However, if PTW was found at the Site during RD, then treatment should be accordingly incorporated into the dredge or cap designs discussed in this decision tree. For dredging, any removal of confirmed PTW would undergo some type of appropriate ex situ treatment (e.g., cement stabilization prior to disposal). Importantly, the PTW guidance makes no requirements about disposal after treatment for PTW material, and PTW determination is not a relevant factor in disposal decisions after treatment takes place. Post dredging residual covers may be needed as indicated by the above demonstration criteria. If so, the concentrations and conditions of the residuals should be	estimated to determine whether they would independently meet the definition of PTW similar to the evaluation of any other “in place” sediments. If the residuals are estimated to meet the PTW definition, then active amendments (e.g., activated carbon) would be added to the residual cover material. For capping, if a cap is proposed to remediate PTW sediments that cap must 1) meet all of the above demonstration criteria including the “containment criteria” and 2) include some “active amendment” layers or materials to provide treatment, even if cap modeling shows that such active materials are not needed to provide protective containment.
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Notes

- 1) Removal of very deep contamination may cause unstable side slopes, adversely impact nearby structures, or other issues. EPA used an FS-level assumption that >15 ft DOI was infeasible to remove. In RD a site specific engineering evaluation would be conducted to determine the feasible depths of removal for any given situation.
- 2) Is contamination deeper than needed or required for navigation depth plus needed cap depth and any cap and navigation safety factors?
- 3) Where dredging is the selected technology, site-specific engineering calculations would be conducted in RD to estimate the range of dredge residual concentrations likely in various dredge management areas. Dredge residuals management procedures such as post-dredge sand covers will be determined in design RD based on the estimated concentrations of residuals relative to the RALs applied at the applicable depth below mudline and may include addition of treatment amendments (e.g., activated carbon) to sand covers if dredge residual concentrations are expected to be relatively high or contain PTW (see PTW step at bottom of decision tree).
- 4) A site-specific RD engineering evaluation would be conducted to determine the cost effectiveness of complete dredging vs. possible dredge and cap back options.
- 5) The “permanance” of a structure would be determined in site-specific RD based on existing and planned future uses for such structures including potential plans for refurbishing or improving the structure to maintain existing uses or expand to additional new uses (i.e., this evaluation is not based on limited by the perceived or actual current structural or physical integrity of the structure).
- 6) Both capping and dredging can be engineered outside the vast majority of areas outside the navigation channel and FMD areas and away from structures. All of the other issues often discussed do not completely rule out the effective design of either capping, dredging, or dredge/cap combination remedies. The most effective of these designs should be determined in RD based on site specific engineering evaluations and any new RD data availabe and/or collected to support such evaluations. These other issues include: presence of rock, bedrock, and debris; flood concerns; slopes; wave, current, and propwash erosion; sediment bed geotechnical stability; depositional areas; shallow areas, and habitat concerns; depth of impact.
- 7) The purpose of demonstration criteria is to determine whether there are any fatal flaws to either a dredging or capping (or dredge/cap combination) remediation approach and verify that the technology would be both effective and protective (including meeting ARARs). Demonstration criteria do not determine the relative cost effectiveness of the technologies. If both technologies are demonstrated to be effective, and capping is feasible considering factors such as current or proposed future site uses, habitat impacts, flood impacts, short term impacts, business concerns, or logistical issues, the most cost effective remedy will be selected.
- 8) The term capping may also include other types of in-situ remediation (e.g., in-situ treatment and thin layer capping). If these other types of in-situ remediation appear preliminarily feasible, the capping demonstration criteria should be generally used but may need to be modified in some cases, particularly for the containment criterion demonstration criterion.

TABLE A

CONCERNS WITH EPA'S
COMPARATIVE ANALYSIS OF
ALTERNATIVES

Table A. Concerns with EPA’s Comparative Analysis of Alternatives

Criteria	EPA Method for Quantification	Alt B	Alt I	EVRAZ Comment
Overall Protectiveness				
Human Health				
RAO 1- Incidental ingestion of sediment and dermal contact	Post-construction risk Compared to interim target of 1x10-5	5x10-5	2x10-5	Not significantly different Sitewide risk between alternatives within uncertainty (factor of 2.5) <ul style="list-style-type: none">• Not significantly different given uncertainties in evaluations (e.g., uncertainty in SWACs, using zero replacement values)• Interim target not justified and selected remedy does not meet target• Variation in post-construction risk between 5x10-5 (Alt B) and 2 x 10-5 (Alt I) is not significant• These are the highest risks by river mile; a range of risks should be provided for these alternatives. For example, almost 7 miles on the east side of the river shows risks for Alternative B in the 10-6 range, with the lowest being 4x10-6 (RM2.2E, 2.3E, 2.4E).• Site risks should be compared to background risk (9x10-6)• Natural recovery since RI and during remedial action period is not considered• Dredge residuals not considered
RAO 2 – Fish/shellfish consumption	Post-construction risk Compared to interim target of 1 x 10-4 <ol style="list-style-type: none">1. sitewide2. RM scale3. SDU Scale	<ol style="list-style-type: none">1. 4x10-42. 2x10-33. 1x10-3	<ol style="list-style-type: none">1. 2x10-42. 4x10-43. 2x10-4	Sitewide not significantly different <ul style="list-style-type: none">• Sitewide risk within uncertainty (factor of 2)• Not significantly different given uncertainties in evaluations (e.g., SWAC uncertainty, use of modeled fish tissue concentrations that are very different from actual fish tissue data. Food web model does not account for upstream surface water concentrations.) RM Scale and SDU scale have further uncertainty and analysis not defensible <ul style="list-style-type: none">• Receptors do not eat fish on 1RM or SDU scale• Post-construction risks should be calculated at the same scale as the food web model was calibrated (sitewide or across an entire river mile). SDU-scale and RM scale (split east and west) risk estimates mis-apply the food web model and are not relevant.• Method to estimate post-construction risks is flawed and inconsistent with the BHHRA; no action alternative showing risks an order of magnitude higher sitewide and up to two orders of magnitude higher on an SDU-scale.• These are the highest risks by river mile and SDU-scale; a range of risks should be provided for these alternatives. Most of the SDU scale risks are between 1x10-4 and 2x10-4.• Post-construction risks for SDU and RM scale were estimated using SDU/RM PRGs that are lower than background (e.g. SDU/RM PRG for PCBs is 0.31 ug/kg whereas EPA’s background is 9 ug/kg and equilibrium is estimated at 20 ug/kg). Site-wide/SDU/RM <ul style="list-style-type: none">• Natural recovery since RI and during remedial action period is not considered

Criteria	EPA Method for Quantification	Alt B	Alt I	EVRAZ Comment
				<ul style="list-style-type: none"> BEHP related to urban runoff and common field/laboratory cross-contaminant Ecological risk is managed on a population scale and even if a home range is within a river mile, the contiguous population is exposed over a larger area.
RAO 7 – Direct contact with surface water	Insufficient data to quantify; time to achieve protectiveness uncertain	Insufficient data	Insufficient data	Alternatives the same; RAO 7 not appropriate
RAO 8 - Migration groundwater to sediment/surface water	Post-construction % of contaminated groundwater areas arbitrarily drawn on Proposed Plan Figure 5	16%	33%	RAO 8 not appropriate. Not a valid measurement. Alternatives within uncertainty <ul style="list-style-type: none"> EPA drawing of groundwater plumes on Figure 5 are arbitrary and overstated and therefore, percentages within the error/uncertainty of analysis DEQ addressing upland sources Stranded wedges addressed as part of remedial design where risk to surface water is identified. Not in anyone's interest to address a remediation area or complete MNR evaluations if upland sources are not addressed.
RAO 9 – Migration riverbanks	Post-construction % of contaminated riverbanks areas arbitrarily drawn on Proposed Plan Figure 6 addressed	32%	65%	RAO 9 not appropriate. Not a valid measurement. Alternatives within uncertainty (essentially factor of 2) <ul style="list-style-type: none"> EPA drawing of riverbanks on Figure 6 are arbitrary, inaccurate, and overstated and therefore, percentages within the error/uncertainty of analysis DEQ will require all banks to be addressed under source control; many banks already addressed. Not in anyone's interest to address a remediation area or complete MNR evaluations if upland sources are not addressed.
Compliance with ARARs				
Chemical-specific ARARs		PCBs, cPAHs, and TCDD eq criteria would not be achieved	Achieved	ARARs are met; surface water AWQC not appropriate. <ul style="list-style-type: none"> Based on an incorrect application of ARARs. Analyses in Appendix K of FS not transparent and appropriate EPA appears to be comparing insitu groundwater concentrations to AWQC; not appropriate Surface water background not considered Application of surface water ARARs to groundwater is not appropriate Change in EPA position between draft FS and final FS
Location-specific ARARs	All Alts comply	Comply	Comply	
Action-specific ARARs	All Alts comply	Comply	Comply	
Long-term Effectiveness and Permanence				
Magnitude of Residual Risks				
RAO 1- Incidental ingestion of sediment and dermal contact	1. Sediment: 2. Beach:	1. 8x residual (background) risk 2. cannot be quantified	1. 3x residual (background) risk 2. cannot be quantified	Alternatives within uncertainty given SWAC analysis and background <ul style="list-style-type: none"> Residual risk is driven by arsenic at background; EPA's background risk for arsenic is underestimated; risks likely close to background
RAO 2 – Fish/shellfish consumption	Post-construction risk compared residual risk (risk at PRG, which is driven by background for PCBs and dioxins/furans)	1. (a) 5x; (b) 6x (c) 6x EPA residual (background) risk	1. (a) 3x; (b) 4x (c) 3x EPA residual (background) risk	Alternatives within uncertainty <ul style="list-style-type: none"> Risks estimated using unrealistic exposure scenarios (e.g., 142 g/day sitewide and 49 g/day SDU/RM every day for 30 years)

Criteria	EPA Method for Quantification	Alt B	Alt I	EVRAZ Comment
	<ol style="list-style-type: none"> 1. Site-wide: (a) Cancer risk;(b) non-cancer child risk; (c) noncancer infant risk 2. RM Scale: (a) Cancer risk;(b) non-cancer child risk; (c) noncancer infant risk 3. SDU scale: (a) Cancer risk;(b) non-cancer child risk; (c) noncancer infant risk <p>Fish consumption advisory needed</p>	<ol style="list-style-type: none"> 2. (a) 53x; (b) 22x (c) 45x EPA residual (background) risk 3. (a) 35x; (b) 17x (c) 27x EPA residual (background) risk <p>Fish consumption advisory needed</p>	<ol style="list-style-type: none"> 2. (a) 13x; (b) 8x (c) 23x EPA residual (background) risk 3. (a) 7x; (b) 4x (c) 5x EPA residual (background) risk <p>Fish consumption advisory needed</p>	<ul style="list-style-type: none"> • Background underestimated; equilibrium for PCBs is 20 ppb; equilibrium for dioxins/furans needs to be estimated • RM scale: Not applicable – receptors do not eat fish from 1 RM or 1 SDU; FWM not applied on the same scale as developed • SDU scale Not applicable – receptors do not eat fish from 1 RM or 1 SDU; FWM not applied on the same scale as developed • Method to estimate post-construction risks is flawed and inconsistent with the BHHRA; no action alternative showing risks an order of magnitude higher sitewide and up to two orders of magnitude higher on an SDU-scale. • Post-construction risks for SDU and RM scale were estimated using SDU/RM PRGs that are lower than background (e.g. SDU/RM PRG for PCBs is 0.31 ppb and EPA's background is 9 ppb and PCBs at equilibrium is 20 ppb).Fish consumption advisory needed for all and for upstream mercury conditions not part of Portland Harbor cleanup
RAO 3 – Direct contact with surface water	Post-construction Surface water concentrations compared to PRG	<ol style="list-style-type: none"> 1. PCB: 13 x PRG 2. TCDD eq: 6 x PRG 3. cPAH: 1.2 x PRG 	<ol style="list-style-type: none"> 4. PCB: 7 x PRG 5. TCDD eq: 5 x PRG 6. cPAH: meets PRG 	<p>RAO 3 not appropriate; Alternatives within uncertainty</p> <ul style="list-style-type: none"> • Background and ongoing sources are not considered • Concentrations cannot be controlled by sediment cleanup • How can this be quantified if there is insufficient data to quantify RAO 7 (Ecological Direct contact with surface water) • Analyses in Appendix K of FS not transparent and appropriate (EVRAZ incorporates LWG comments on this Appendix by reference)
RAO 4 – Migration of groundwater to sediment/surface water	Post-construction % of contaminated groundwater areas arbitrarily drawn on Proposed Plan Figure 5	84%	67%	<p>RAO 4 not appropriate; Alternatives within uncertainty</p> <ul style="list-style-type: none"> • EPA drawing of groundwater plumes on Figure 5 are arbitrary and overstated and therefore, percentages within the error/uncertainty of analysis • DEQ addressing upland sources • Stranded wedges addressed as part of remedial design where risk to surface water is identified. Not in anyone's interest to address a remediation area or complete MNR evaluations if upland sources are not addressed.
Environment				
RAO 5 – Benthic Organisms	Percent of benthic risk not addressed	52%	36%	<ul style="list-style-type: none"> • Benthic risk criteria are arbitrary and overreaching (see LWG comments) • EPA's target benthic risk areas do not match areas identified by the CBRA and more importantly do not match areas of actual observed toxicity, so not meeting 52% vs 36% is meaningless • Natural recovery and upland source control since RI and during remedial action period is not considered is not considered
RAO 6 – Consumption of Prey	Post-construction HQ greater than EPA background HQ of 1 <ol style="list-style-type: none"> 1. RM Scale 2. SDU Scale 	<ol style="list-style-type: none"> 1. RM Scale BEHP- 34 PCB – 6 TCDF - 6 PeCDF – 4 HxCDF - 3 2. SDU Scale BEHP – 11 	<ol style="list-style-type: none"> 1. RM Scale BEHP- 19 PCB – 2 TCDF - 1 PeCDF – 1 HxCDF – 1 2. SDU Scale BEHP – 4 	<p>Within uncertainty</p> <ul style="list-style-type: none"> • Ecological risk is managed on a population scale and even if a home range is within a river mile, the contiguous population is exposed over a larger area. • Risk based on modeled tissue concentrations, results are uncertain (especially for dioxins/furans) • Natural recovery and upland source control since RI and during remedial action period is not considered is not considered • BEHP, the main driver for RAO6, is a localized issue (Swan Island) and urban runoff contaminant

Criteria	EPA Method for Quantification	Alt B	Alt I	EVRAZ Comment
		PCB – 5 TCDF - 3 PeCDF -2 HxCDF - 2	PCB – 1 TCDF - 1 PeCDF -1 HxCDF - 1	
RAO 7 – Direct contact with surface water	Insufficient data	Insufficient data	Insufficient data	
RAO 8 - Migration groundwater to sediment/surface water	Post-construction % of contaminated groundwater areas arbitrarily drawn on Proposed Plan Figure 5	84%	67%	RAO 8 not appropriate; Alternatives within uncertainty <ul style="list-style-type: none"> EPA drawing of groundwater plumes on Figure xxx are arbitrary and overstated and therefore, percentages within the error/uncertainty of analysis DEQ addressing upland sources Stranded wedges addressed as part of remedial design where risk to surface water is identified. Not in anyone’s interest to address a remediation area or complete MNR evaluations if upland sources are not addressed.
RAO 9 – Migration riverbanks	Post-construction % of contaminated riverbanks areas arbitrarily drawn on Proposed Plan Figure 6 addressed	68%	25%	RAO 9 not appropriate; Alternatives within uncertainty (essentially factor of 2) <ul style="list-style-type: none"> EPA drawing of riverbanks on Figure 6 are arbitrary, inaccurate and overstated and therefore, percentages within the error/uncertainty of analysis DEQ will require all banks to be addressed under source control; many banks already addressed. Not in anyone’s interest to address a remediation area or complete MNR evaluations if upland sources are not addressed.
Adequacy and Reliability of Controls	Reliable technologies with monitoring; institutional controls	equivalent	equivalent	Technologies the same (although some acreage increase); adequacy and reliability of controls is consistent
Reduction of Toxicity, Mobility or Volume Through Treatment				
Treatment Process Used and Material Treated	same			Equivalent
Amount Destroyed or Treated	1. Ex situ treatment 2. In situ treatment	1. 192,000 cy 2. 70 acres	1. 192,000 cy 2. 113 acres	Alternatives essentially equivalent; insitu difference is arbitrary and unsupported <ul style="list-style-type: none"> Ex situ treatment equivalent The definition of PTW – highly toxic is incorrect. The estimated amount of actual destruction or treatment (i.e. sequestration) of contaminants for in situ technologies is not quantified in FS and is highly uncertain, particularly for “Broadcast AC” and “Reactive Residual Layer”. Accordingly, the incremental difference between alternatives is considered to be negligible for this parameter.
Reduction in Toxicity, Mobility, or Volume	1. Broadcast activated carbon 2. Reactive cap 3. Reactive Residual Layer 4. Significantly augmented reactive cap	1. 6.7 acres 2. 23 acres 3. 36.5 acres 4. 3.8 acres	1. 3.2 acres 2. 64 acres 3. 46 acres 4. 0 acres	<ul style="list-style-type: none"> The estimated amount of reduction in toxicity, mobility, or volume of contaminants for insitu technologies is not quantified in FS and is highly uncertain, particularly for “Broadcast AC” and “Reactive Residual Layer”. Accordingly, the incremental difference between alternatives is considered to be negligible for this parameter.
Irreversible Treatment	same			

Criteria	EPA Method for Quantification	Alt B	Alt I	EVRAZ Comment
Type and Quantity of Residuals Remaining after Treatment	Percent of PTW addressed	37%	57%	Highly toxic PTW defined inconsistent with guidance and practice All potentially mobile PTW is addressed; highly toxic PTW is not an appropriate metric
Short-term Effectiveness				
Community Protection	Noise, lights, odors, air quality impacts Disruptions to commercial and recreational river use, waterborne accidents Fish consumption advisories exist	4 years (4 months per year)	7 years (4 months per year)	Alt B favored <ul style="list-style-type: none"> Overall duration underestimated production rate/effective working hours overestimated (e.g., time for repositioning vessels) and time to barge materials to transload facility is underestimated. Disruptions will occur for longer than the 4-month fish window given that upland support activities will continue throughout the entire duration of the cleanup as well as projected extensions of fish window, riverbank work. EPA assertion that controllable, addressed through implementation of H&S plans and use of BMPs is inconsistent with projected time frame and 24-hour working approach. Plans and BMPs are required as standard practice and do not fully prevent incidents. Outside of remedial action area during transport, community not required to follow plans and BMPs. Dredge material releases and Spills are inevitable while barging impacted materials long distances down the Columbia River to a transload facility.
Worker Protection	Risk to workers; physical hazards and chemical exposure; increased accidents	4 years (4 months per year)	7 years (4 months per year)	Alt B favored <ul style="list-style-type: none"> EPA assertion that controllable and addressed through BMP and H&S Plan is overstatement – incidents still occur
Environmental Impacts	Ecological impacts from construction activities; temporary loss of benthos and habitat, increased emissions from construction and transportation equipment; exposure to contamination greater during MNR period	4 years (4 months per year)	7 years (4 months per year)	Alt B favored <ul style="list-style-type: none"> Impact of dredge residuals not identified and not fully controllable – should consider dredge volumes and associated residuals, as well as years. EPA assertion that controllable and addressed through BMP and H&S Plan is overstatement – incidents still occur – ecological receptors don't follow plans MNR period not quantified and likely same. Greenhouse gas emissions were not considered. Resource use on borrow pits not considered. Energy use not considered. Elevated fish tissue concentrations related to construction activity will persist throughout the entire duration of the cleanup (which is greater than estimated by EPA).
Time until Action is complete		4 years (4 months per year) Estimated time to achieve RAOs uncertain	7 years (4 months per year) Estimated time to achieve RAO uncertain	Equivalent <ul style="list-style-type: none"> Construction period not applicable. Action complete upon attaining PRG. PRG likely can't be met; if met, will depend on source control within the river and in the watershed. EPA does not use fate and transport model to quantify and has not basis for differential weighting.
Implementability				
Ability to construct and operate	Technologies successfully implemented at other Superfund sites and recommended by guidance Material handling volumes listed	496,000 cy clean import 628,000 cy contaminated sediment removed	900,000 cy clean; 1,753,000 cy contaminated	Technologies the same; ability to construct favored by smaller volume of import and export

Criteria	EPA Method for Quantification	Alt B	Alt I	EVRAZ Comment
	Coordination among agencies, private entities and community Structures and debris			<ul style="list-style-type: none">Challenges to finding imported material (Columbia River sediment not “clean”). Only so much source material available at locations like Lewis River, particularly without causing environmental impacts in source area.Current contaminated sediment handling plan is not feasible.3 times the contaminated volume and extended duration will result in significantly greater coordination and challenges with structures and debris.Implementability is uncertain given uncertain basis, technical feasibility, and performance of broadcast GAC, reactive residual layer, and sheetpile containment.
Ease of doing more action if needed	same			
Ability to Monitor Effectiveness	Regular monitoring of caps required under 5-year review MNR monitoring to demonstrate effectiveness Monitoring of fish consumption	RNA=28 39 cap acres 1966 MNR acres	RNA=81 102 cap acres 1876 MNR acres	All remedies use same technologies and have same ability to monitor effectiveness Larger capping alternatives will require more extensive monitoring and drive higher cost; however ability to monitor is equivalent given equivalent technologies
Ability to obtain approvals and coordinate with other agencies	Extending work periods each year	2,088 acres waste left in place	2,000 acres of waste left in place	Favors Alt B Note that extended work periods not considered in yearly estimate. Definition of “waste” is incorrect. Larger/longer alternatives will require additional approvals and coordination with agencies
Availability of specialists, equipment and materials	Availability of services, equipment, and materials Availability and capacity of offsite treatment and disposal facilities Availability of experienced dredge operators and material placement specialists Number of barge, truck, and rail loads used as surrogate for this parameter.	434 barge loads 42,439 truckloads or 10,576 rail loads are assumed to transport the removed material offsite. Additionally 309 barge loads, 36,213 truckloads, or 7,834 rail loads are assumed to transport material into the Site.	1,160 barge loads 116,118 truckloads or 28,982 rail loads are assumed to transport the removed material offsite. Additionally 611 barge loads, 74,632 truckloads, or 15,659 rail loads are assumed to transport material into the Site.	Favors Alt B The availability of specialists, equipment, and materials expected to be significantly less for larger, longer-duration alternatives, particularly considering other regional remediation projects that are expected to occur in the region in the same general timeframe (e.g., Lower Duwamish Waterway, East Waterway)
Availability of technologies	Same			
Cost				
	EPA FS estimate (non-discounted)	\$642,421,000	\$1,173,299,000	Alt B is lower cost Independent estimates by multiple engineering companies indicates EPA’s FS costs are underestimated by a factor of 1.5 or greater (Alt B = \$964,000,000; Alt I = \$1,760,000,000. EPA’s FS lacks a meaningful comparison of incremental benefits and costs. Independent analyses indicates there is little if any incremental benefit (per NCP criteria) between Alternatives B and I, while the incremental cost of Alternative B is approximately \$0.8 Billion greater than Alternative I.

ATTACHMENT 1

**REVIEW OF THE PORTLAND
HARBOR DRAFT FINAL FEASIBILITY
STUDY COST ESTIMATES**



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ATTACHMENT 1

Subject: Review of the Portland Harbor draft final feasibility study cost estimates

This memorandum summarizes Integral Consulting Inc.'s (Integral's) technical review of the remedial cost estimates provided in the U.S. Environmental Protection Agency's (EPA's) draft final Feasibility Study (FS) for Portland Harbor (USEPA and CDM Smith 2016). The estimated costs and associated major costing assumptions were reviewed for transparency, and consistency with the state of practice for feasibility studies conducted for CERLCA sediment mega-sites. The overall goal of this analysis was to determine if EPA has developed a reasonably reliable FS estimate of the cost for the proposed remedy, in a manner that is consistent with EPA costing guidance and experience at similar sites..

APPROACH

The cost analysis presented in the FS was reviewed on a line item basis. Quantities and major cost assumptions associated with each line item, where available, were reviewed with respect to:

- Transparency
- Completeness
- Degree of potential uncertainty
- Parity to sites of similar scope and scale.

This review focused on determining the degree to which EPA had accurately assessed the true cost of its proposed remedy, Alternative I. The findings of this evaluation should be considered by EPA in developing the final FS costs to ensure a realistic projection of the

potential range of remedial costs and to facilitate balanced comparison of the remedial alternatives.

Following review of the EPA's cost estimates and supporting documentation, an independent estimate of the potential cost of Alternative I was prepared. This estimate focused on developing unit rates that were consistent actual costs for recently completed projects, recently detailed FS estimates for other regional and national sediment mega-sites, and best professional judgement. To facilitate a side-by-side comparison with the FS, all of EPA's FS design assumptions (e.g., preliminary remediation goals [PRG]/remedial action levels, remedial boundaries, quantities, durations, etc.) were maintained.

RESULTS

Key findings from Integral's review of EPA's FS cost estimate is presented, on a line item basis, in Table 1. While insufficient information is included in the FS to fully understand the basis and assumptions for many of the line item costs, the available evidence strongly indicates that EPA has underestimated costs for many direct and indirect costs. An independent best estimate of the potential cost of Alternative I is presented in Table 2. A high level summary of the same, including net present value figures, is presented in Table 3.

DISCUSSION

Integral's review of EPA's remedial quantities and estimated costs revealed considerable uncertainty associated with many of the individual line items due to a general lack of transparency in EPA's FS. Further, this review indicated that EPA's estimate for many key line items appear to be significantly low. As indicated in Tables 1 through 3, key cost items underestimated by EPA include:

- **Institutional Controls.** The FS focuses on installing and setting up buoys and signage on docks, but omits consideration of costs related to potential encumbrances on private or Department of State Lands (DSL) land from caps. We anticipate this will be considerable expense given that Alternative I includes approximately 64 acres of caps. Areas where a permanent cap is placed on DSL land will incur costs to purchase or lease the land.
- **Erosion/Residual Controls.** EPA significantly underestimates the technical challenges and associated cost to broadly implement sheet-pile containment as an erosion/residual control measure. The costs presented in the FS do not reflect consideration of structural bracing and/or cofferdam structures that would be

necessary to facilitate use of this technology given the physical site conditions (e.g. water depth, sediment thickness).

- **Dredging.** The assumed unit rate for dredging is low based on experience on similar projects. The unit rate presented in the FS is influenced by EPA's optimistic assumptions regarding production rates, which do not reflect the reduced efficiency associated with the assumed erosion/residual control measures and best management practices. EPA's assumed unit costs for dredging include provisions for "open water" and "confined" activities, the latter assumed to be more technically challenging and costly. However, despite having a significant influence on the overall cost, the FS does not transparently identify which parts of the river necessitate "open water" or "confined" activities.
- **Disposal.** The unit rate for both Subtitle D and Subtitle C disposal are low relative to experience on similar projects. The FS does not demonstrate that the assumed transloading facility has sufficient capacity to efficiently handle the assumed disposal quantities.
- **Transload Facility Development.** The FS unit cost is based on a reduced version of the estimate provided in the Lower Willamette Group's FS (Anchor QEA et al. 2012) for site/facility development. The basis for reducing the original estimate is unclear. Given a key FS assumption that at least two separate transloading facilities will be used (separate Subtitle C and Subtitle D transloading), it is inappropriate for EPA's FS to rely upon the prior estimate that does not consider the same logistical constraints.
- **Mitigation.** The basis for mitigation areas is poorly documented and justified. There may be some overlap of armored shallow areas above 4 ft NAVD 88 that are also assigned 6 inches of beach mix as a habitat layer. It is unclear why areas receiving beach mix would require mitigation. The effect and extent of this overlap are unknown.
- **Contingency, Project Management, Remedial Design, and Construction Management.** Estimated as a percentage of direct construction costs, EPA uses percentages for each of these line items that is below the range recommended by guidance (USEPA 2000). This is not warranted given the high degree of uncertainty associated with the FS conceptual design and cost assumptions (particularly removal volumes, treatment requirements, and project duration) and known and suspected errors in FS analyses. Additionally, EPA has omitted provision for agency oversight costs, which, based on historical costs for performance of the RI/FS, are expected to be significant.

- **Monitored Natural Recovery Costs.** While the FS includes costs for monitoring of areas receiving *in situ* treatment, enhanced natural recovery, or monitored natural recovery, there is no indication that the FS includes provisions for baseline monitoring of the entire site to support evaluation of sitewide PRGs. Additionally, it does not seem that the FS considers costs for area-specific pre-design sampling, which will likely have a similar magnitude as baseline sampling.

CONCLUSIONS

Based on the review and independent estimate presented herein, it appears that EPA has underestimated the cost of Alternative I by as much as 50 percent. When considering the typical accuracy of FS estimates, the actual cost to implement Alternative I could exceed EPA's FS estimate by up to 100 percent.

In summary, the level of detail, accuracy, and documentation of EPA's FS estimate for Alternative I does not appear to be consistent FS costing guidance, the standard of practice required of FS estimates for similar CERCLA sites, or recent project experience. Further, the deficiencies identified in EPA's FS estimate for Alternative I are generally applicable to the other FS alternatives. This has resulted in an unrealistic projection of the overall range of potential cleanup costs; thus, an insufficient basis for comparison of the alternative or selection of a preferred remedy.

REFERENCES

Anchor QEA, Windward, Kennedy/Jenks, and Integral. 2012. Portland Harbor RI/FS draft feasibility study. Prepared for The Lower Willamette Group, Portland, OR. Anchor QEA, LLC, Seattle, WA; Windward Environmental LLC, Seattle, WA; Kennedy/Jenks Consultants, Portland, OR; and Integral Consulting Inc., Portland, OR. March 30.

USEPA. 2000. A guide for developing and documenting cost estimates during the feasibility study. EPA 540-R-00-002. OSWER 9355.0-75. U.S. Army Corps of Engineers, Hazardous, Toxic, and Radioactive Waste Center of Expertise, Omaha, NE, and U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC. July.

USEPA and CDM Smith. 2016. Portland Harbor RI/FS, feasibility study. U.S. Environmental Protection Agency and CDM Smith Inc. June.

Table 1. Review of EPA FS Cost Assumptions

FS Cost Item	Observations
Institutional Controls Capital Costs	
Initial Establishment of Institutional Controls	FS focuses on installing and setting up buoys and signage on docks, but omits mention of costs related to potential encumbrances on private or DSL land from caps. Anticipate this will be considerable expense given Alternative I includes ~64 acres of caps. Based on past experience, actual cost may be 1.5 to 3 times greater.
Contingency (Scope and Bid)	The FS uses percentage (15%) that is outside the range recommended by guidance (20 to 45%) (USEPA 2000). A higher contingency is warranted due to the high degree of uncertainty associated with the conceptual design and cost assumptions (particularly removal volumes and project duration) and known and suspected errors in FS analyses.
Project Management	The FS uses lower percentage (2%) than recommended by guidance (5%) based on project scale. This is not warranted given overall uncertainty in FS design/analysis and extensive administrative, coordination, and regulatory requirements typical of large complex CERCLA projects.
Remedial Design	The FS uses a lower percentage (2%) than recommended by guidance (6%) based on project scale. This is not warranted given overall uncertainty in FS design/analysis and extensive administrative, coordination, and regulatory requirements typical of large complex CERCLA projects.
Construction Management	The FS uses a lower percentage (2%) than recommended by guidance (6%) based on project scale. This is not warranted given overall uncertainty in FS design/analysis and extensive administrative, coordination, and regulatory requirements typical of large complex CERCLA projects.
Monitored Natural Recovery Capital Costs	
Monitored Natural Recovery (MNR) for MNR/Enhanced Monitored Natural Recovery (EMNR) and Broadcast GAC Areas	The FS defines as the unit cost per acre of site receiving broadcast granular activated carbon (<i>in situ</i> treatment), ENR, or MNR. However, FS monitoring costs should include baseline monitoring of the whole site, regardless of technology, for comparison to sitewide PRGs. The notes in FS estimate (sheet CS-X) erroneously say this item includes dredge areas, but the reported area does not support this. Additionally, it does not appear this item is meant to include provisions for area-specific pre-design sampling, which will likely have similar magnitude as baseline sampling.
Contingency (Scope and Bid)	Same comment as above.
Project Management	Same comment as above.
Remedial Design	Same comment as above.
Construction Management	Same comment as above.

Table 1. Review of EPA FS Cost Assumptions

FS Cost Item	Observations
Technology Assignments Measures Capital Construction Costs	
Mobilization/Demobilization	FS estimates mobilization/demobilization at 1.6% of total capital costs, which is anticipated to be slightly low for a project of this size and complexity. Mob/demob costs from past projects range 1.6% to 5%.
Transload Facility Development	FS applies a reduction to the estimate provided in the LWG's FS for Site/Facility Development. The original LWG FS estimate is more realistic. Given the FS assumption that at least two separate transloading facilities will be used (separate Subtitle C and Subtitle D transloading), an independent approach should be used to more realistically estimate costs and consider logistical constraints.
Debris Removal and Disposal	EPA's unit cost per acre for debris removal and disposal is low in comparison to other sites with moderate to heavy debris. EPA's unit cost for debris removal and disposal was based on an Anchor QEA 2010 estimate for the removal and disposal of 15 debris items in a 2-acre area and should be updated to reflect actual moderate to heavy debris conditions identified on EPA Final FS Figure 3.4-25.
Obstruction Removal and Relocation	Unit cost—EPA unit costs for three sub-elements (piling removal, piling replacement, and temporary dock relocation) are based on quotes for piling removal and replacement that could not be fully evaluated (not transparent). Temporary dock relocation costs may be based on the removal and replacement of 10 pilings, which may be low depending upon the structures to be relocated.
Erosion/Residual Control Measures	FS underestimates the considerable expense associated with wide-scale use of sheetpiling as erosion/residual control measure. Use in deeper water areas, or areas with shallow sediment require structural bracing and/or cofferdam structures that are not reflected in the assumed unit cost. Silt curtain unit costs are reasonable for ideal conditions. Costs are likely higher for areas with strong currents. Additionally, management of silt curtains to facilitate vessel movements can be quite costly.
Dredging of Contaminated Sediments (Open Water)	The FS unit rate for dredging is low based on experience on similar projects. The unit rate is influenced by EPA's optimistic assumptions regarding production rates, which do not seem to account for the reduced efficiency associated with the assumed erosion/residual control measures and BMPs.
Dredging of Contaminated Sediments (Confined)	The FS unit rate for dredging is low based on experience on similar projects. The unit rate is influenced by EPA's optimistic assumptions regarding production rates, which do not seem to account for the reduced efficiency associated with the assumed erosion/residual control measures and BMPs.
Excavation of Contaminated Sediments (From Shore for Riverbanks)	The FS unit rate for excavation is low based on experience on similar projects.

Table 1. Review of EPA FS Cost Assumptions

FS Cost Item	Observations
Dewatering and Water Treatment for Dredging Operations	The estimated duration of dewatering/water treatment operations presented in FS is low. FS assumes number of days based on division of total dredge quantity by dredging production rate. A more appropriate assumption is that water treatment system will operate 75% of all construction days. EPA mob/demob cost based on assumed temporary system is low.
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select PTW Materials, and Disposal)	The FS unit rate (\$191/ton) for Subtitle C Disposal is low based on experience on similar projects. A more appropriate FS unit rate is \$220/ton. The FS does not demonstrate the assumed transloading facility has sufficient capacity to efficiently handle the assumed disposal quantities.
Subtitle D Disposal (Handling, Transportation, and Disposal)	The FS unit rate (\$111/ton) for Subtitle D Disposal is low based on experience on similar projects. Considering conceptual design consisting of barge transportation and use of transloading facilities upstream on the Columbia River, a more appropriate FS unit rate is \$120/ton. The FS does not demonstrate the assumed transloading facility has sufficient capacity to efficiently handle the assumed disposal quantities.
Mitigation	The FS unit cost is slightly low relative to other recent projects. The basis for mitigation areas is poorly documented/justified. There may be some overlap of armored shallow areas above 4 ft NAVD 88 that are also assigned 6 inches of beach mix as a habitat layer. It is unclear why areas receiving beach mix would require mitigation. The effect and extent of this overlap are unknown.
Sand Placement for Technology Assignments	The FS utilizes a low conversion factor to convert tons to cubic yards, which results in underestimate of cost. Unlike removal volumes, FS uses neat line volumes to estimate sand placement cost (i.e., no provisions for overplacement).
Beach Mix Placement for Technology Assignments	The FS unit rate for beach mix placement is realistic. As with sand placement, the FS uses neat line volumes to estimate this cost.
Armor Placement for Technology Assignments	The FS utilizes a low conversion factor to convert tons to cubic yards, which results in underestimate of cost. Also omits provisions for overplacement.
Reactive/GAC Placement for Technology Assignments	The FS unit rate for reactive/GAC placement is low based on experience on similar projects. Assumed quantities omit provisions for overplacement.
Geofabric for Riverbanks	The FS unit rate for geofabric is low based on experience on similar projects.
Organoclay Mat Placement for Technology Assignments	FS cost backup suggests construction/placement has been assumed to include divers. The FS unit rate for organoclay mat placement is low based on experience on similar projects.
Contingency (Scope and Bid)	Same comment as above.
Project Management	Same comment as above.
Remedial Design	Same comment as above.
Construction Management	Same comment as above.

Table 1. Review of EPA FS Cost Assumptions

FS Cost Item	Observations
Sitewide Monitoring and Monitored Natural Recovery Periodic Costs	
Monitored Natural Recovery (MNR) for MNR/Enhanced Monitored Natural Recovery (EMNR) and Broadcast GAC Areas	Unit cost is low based on experience at other sites. FS estimate based on monitoring of surface sediments in areas receiving <i>in situ</i> treatment, ENR, or MNR. FS provides no indication this item includes provisions for monitoring of dredge areas.
Sitewide Monitoring	Unit cost is low based on experience at other sites. Unit cost includes monitoring of sitewide surface water and tissue monitoring but omits monitoring of sediment for comparison to PRGs. This item does not change by alternative.
Cap Area Monitoring and Reactive Layer Monitoring	This line item lumps together porewater sampling in "reactive layers," which include caps/backfill and areas where dredge residual cover includes carbon. They also include sediment monitoring of caps. The cap area reported in Appendix D is inconsistent with the cap area reported in other parts of the FS. FS estimate reflects emphasis on use of activated carbon.
Contingency (Scope and Bid)	Same comment as above.
Project Management	Same comment as above.
Technical Support	No comment.
Long-term Operations and Maintenance	
Long-term Maintenance for Capping, EMNR, and <i>In Situ</i> Treatment	The FS unit rate for long-term maintenance is low based on experience on similar projects.
Contingency (Scope and Bid)	Same comment as above.
Project Management	FS estimate is consistent with guidance (USEPA 2000).
Technical Support	No comment.
Institutional Controls Periodic Costs	
Evaluating and Updating Institutional Controls	Task description includes manual labor to install signs and buoys, and to purchase buoys. Costs for these elements increase by alternative. FS estimate omits mention of professional services (e.g., reviewing and filing restrictive covenants, etc.). Description provides little explanation of what has been assumed to be included. For example, the number of docks in an SMA footprint is rationale for costs that change by alternative, but what happens at these docks is not specified (presumably signage).
Contingency (Scope and Bid)	Same comment as above.
Project Management	FS estimate is consistent with guidance (USEPA 2000).
Technical Support	No comment.

Table 1. Review of EPA FS Cost Assumptions

FS Cost Item	Observations
5-Year Site Review Periodic Costs	
5-Year Site Review	This cost seems low based on experience and recent estimates for similar sites.
Contingency (Scope and Bid)	Same comment as above.
Project Management	FS estimate is consistent with guidance (USEPA 2000).
Technical Support	No comment.

Notes:

BMP = best management practice
DSL = Department of State Lands
EMNR = enhanced monitored natural recovery
EPA = U.S. Environmental Protection Agency
FS = feasibility study
GAC = granular activated carbon
LWG = Lower Willamette Group
MNR = monitored natural recovery
PRG = preliminary remediation goal
PTW = principal threat waste
SMA = sediment management area
TSCA = Toxic Substances Control Act

Table 2. EPA Estimated FS Costs vs. Independent Estimate

FS Cost Item	UNIT	EPA 2016 Final FS			Independent Estimate			DIFFERENCE
		QTY	UNIT COST	TOTAL	QTY	UNIT COST	TOTAL	
Institutional Controls Capital Costs								
Initial Establishment of Institutional Controls	LS	1	\$3,028,033	\$3,028,033	1	\$6,056,066	\$6,056,066	\$3,028,033
Contingency (Scope and Bid)		15%		\$454,205	35%	35%	\$2,119,623	\$1,665,418
Project Management		2%		\$69,645	4%		\$327,028	\$257,383
Remedial Design		2%		\$69,645	5%		\$408,784	\$339,140
Construction Management		3%		\$104,467	5%		\$408,784	\$304,317
TOTAL				\$3,726,000			\$9,320,000	\$5,594,000
Monitored Natural Recovery Capital Costs								
Monitored Natural Recovery (MNR) for MNR/Enhanced Monitored Natural Recovery (EMNR) and Broadcast GAC Areas	AC	1,937		\$7,139,782	1,937	\$7,372	\$14,279,564	\$7,139,782
Contingency (Scope and Bid)		20%		\$1,427,956	30%		\$4,283,869	\$2,855,913
Project Management		5%		\$428,387	5%		\$928,172	\$499,785
Remedial Design		8%		\$685,419	6%		\$1,113,806	\$428,387
Construction Management		6%		\$514,064	6%		\$1,113,806	\$599,742
TOTAL				\$10,196,000			\$21,719,000	\$11,523,000
Technology Assignments Measures Capital Construction Costs								
Mobilization/Demobilization	LS	1	\$9,044,672	\$9,044,672	1	\$21,488,024	\$21,488,024	\$12,443,352
Transload Facility Development	LS	1	\$10,528,998	\$10,528,998	1	\$15,100,000	\$15,100,000	\$4,571,002
Debris Removal and Disposal	AC	292	\$13,107	\$3,827,244	292	\$21,304	\$6,220,622	\$2,393,378
Obstruction Removal and Relocation	LS	1	\$15,146,379	\$15,146,379	1	\$18,175,655	\$18,175,655	\$3,029,276
Erosion/Residual Control Measures	LS	1	\$25,227,895	\$25,227,895	1	\$44,600,000	\$44,600,000	\$19,372,105
Dredging of Contaminated Sediments (Open Water)	CY	1,556,599	\$24.53	\$38,183,373	1,556,599	\$58.00	\$90,282,742	\$52,099,369
Dredging of Contaminated Sediments (Confined)	CY	93,151	\$31.10	\$2,896,996	93,151	\$65.00	\$6,054,815	\$3,157,819
Excavation of Contaminated Sediments (From Shore for Riverbanks	CY	102,624	\$5.19	\$532,619	102,624	\$8.50	\$872,304	\$339,685
Dewatering and Water Treatment for Dredging Operations	LS	1	\$7,261,269	\$7,261,269	1	\$15,600,000	\$15,600,000	\$8,338,731

Table 2. EPA Estimated FS Costs vs. Independent Estimate

FS Cost Item	UNIT	EPA 2016 Final FS			Independent Estimate			DIFFERENCE
		QTY	UNIT COST	TOTAL	QTY	UNIT COST	TOTAL	
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select PTW Materials, and Disposal)	Ton	358,888	\$190.97	\$68,536,841	358,888	\$220.00	\$78,955,360	\$10,418,519
Subtitle D Disposal (Handling, Transportation, and Disposal)	Ton	2,534,454	\$110.76	\$280,716,125	2,534,454	\$120.29	\$304,856,799	\$24,140,674
Mitigation	AC	34	\$1,070,827	\$36,408,118	34	\$1,185,414	\$40,304,059	\$3,895,941
Sand Placement for Technology Assignments	CY	598,578	\$34.00	\$20,351,652	598,578	\$45.00	\$26,936,010	\$6,584,358
Beach Mix Placement for Technology Assignments	CY	49,511	\$73.43	\$3,635,593	49,511	\$73.43	\$3,635,593	\$0
Armor Placement for Technology Assignments	CY	80,297	\$72.27	\$5,803,064	80,297	\$84.00	\$6,744,948	\$941,884
Reactive/GAC Placement for Technology Assignments	LS	1	\$44,759,377	\$44,759,377	1	\$55,949,221	\$55,949,221	\$11,189,844
Geofabric for Riverbanks	AC	21.2	\$14,311	\$303,393	21	\$24,200	\$513,040	\$209,647
Organoclay Mat Placement for Technology Assignments	SF	174,300	\$6.73	\$1,173,039	174,300	\$8.41	\$1,466,299	\$293,260
Contingency (Scope and Bid)		20%		\$114,867,329	35%		\$258,214,422	\$143,347,092
Project Management		2%		\$13,784,080	4%		\$39,838,797	\$26,054,717
Remedial Design		2%		\$13,784,080	5%		\$49,798,496	\$36,014,416
Construction Management		3%		\$20,676,119	5%		\$49,798,496	\$29,122,376
TOTAL				\$737,448,000			\$1,135,406,000	\$397,958,000
Sitewide Monitoring and Monitored Natural Recovery Periodic Costs								
Monitored Natural Recovery (MNR) for MNR/Enhanced Monitored Natural Recovery (EMNR) and Broadcast GAC Areas	AC	1,937	\$3,686	\$7,139,782	1,937	\$6,451	\$12,494,619	\$5,354,837
Sitewide Monitoring	LS	1	\$957,659	\$957,659	1	\$1,436,489	\$1,436,489	\$478,830
Cap Area Monitoring and Reactive Layer Monitoring	LS	1	\$21,828,717	\$21,828,717	1	\$21,828,717	\$21,828,717	\$0
Contingency (Scope and Bid)		20%		\$5,985,232	35%		\$12,515,938	\$6,530,707
Project Management		2%		\$718,228	4%		\$1,931,030	\$1,212,803
Technical Support		5%		\$1,795,569	5%		\$2,413,788	\$618,219
TOTAL				\$38,425,000			\$52,621,000	\$14,196,000

Table 2. EPA Estimated FS Costs vs. Independent Estimate

FS Cost Item	UNIT	EPA 2016 Final FS		Independent Estimate			DIFFERENCE	
		QTY	UNIT COST	TOTAL	QTY	UNIT COST		TOTAL
Long-term Operations and Maintenance								
Periodic Costs								
Long-term Maintenance for Capping, EMNR, and <i>In Situ</i> Treatment	LS	1	\$3,862,654	\$3,862,654	1		\$5,793,981	\$1,931,327
Contingency (Scope and Bid)		20%		\$772,531	35%		\$2,027,893	\$1,255,363
Project Management		5%		\$231,759	5%		\$391,094	\$159,334
Technical Support		10%		\$463,518	10%		\$782,187	\$318,669
TOTAL				\$5,330,000			\$8,995,000	\$3,665,000
Institutional Controls Periodic Costs								
Evaluating and Updating Institutional Controls	LS	1	\$507,467	\$507,467	1	\$634,334	\$634,334	\$126,867
Contingency (Scope and Bid)		10%		\$50,747	35%		\$222,017	\$171,270
Project Management		5%		\$27,911	5%		\$42,818	\$14,907
Technical Support		10%		\$55,821	10%		\$85,635	\$29,814
TOTAL				\$642,000			\$985,000	\$343,000
5-Year Site Review Periodic Costs								
5-Year Site Review	LS	1	\$243,687	\$243,687	1		\$731,061	\$487,374
Contingency (Scope and Bid)		10%		\$24,369	35%		\$255,871	\$231,503
Project Management		5%		\$13,403	5%		\$49,347	\$35,944
Technical Support		10%		\$26,806	10%		\$98,693	\$71,888
TOTAL				\$308,000			\$1,135,000	\$827,000

Notes:

EMNR = enhanced monitored natural recovery
EPA = U.S. Environmental Protection Agency
FS = feasibility study
GAC = granular activated carbon
MNR = monitored natural recovery
PTW = principal threat waste
TSCA = Toxic Substances Control Act

Table 3. Summary Including Net-present Value

	EPA 2016 Final FS	Independent Estimate
Capital Costs		
Institutional Controls	\$3,726,000	\$9,320,000
Monitored Natural Recovery	\$10,196,000	\$21,719,000
Technology Assignments	\$737,448,000	\$1,135,406,000
Periodic Costs		
Annual Operations and Maintenance	\$0	\$0
Long-term Monitoring and Monitored Natural Recovery	\$384,250,000	\$526,210,000
Long-term Operations and Maintenance and Institutional Controls	\$35,832,000	\$59,880,000
Five-Year Site Reviews	\$1,848,000	\$6,810,000
Total Cost (Non-discounted)	\$1,173,300,000	\$1,759,345,000
Total Net-present Value (7% Interest)	\$811,296,617	\$1,231,077,825

Notes:

EPA = U.S. Environmental Protection Agency
FS = feasibility study

ATTACHMENT 2

USE OF TAP WATER RSL FOR
MANGANESE FOR RAO 4 IS NOT
APPROPRIATE



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ATTACHMENT 2

Subject: Use of Tap Water RSL for Manganese for RAO 4 is not Appropriate

EPA's Proposed Plan for Portland Harbor states that the manganese (Mn) Remedial Action Objective of 430 $\mu\text{g/L}$ should be used for this site and indicates in Table 2.2-7 of the FS that this number is based on the EPA risk based screening level (RSL) for Mn for residential groundwater exposure at a risk of 10^{-6} . The number used as the PRG (430 $\mu\text{g/L}$) correlates to the RSL with a hazard index of 1. However, the basis of this RSL is not technically accurate; the RSL is constructed by a mathematical manipulation of the EPA IRIS value based on personal communication with the "IRIS author." This manipulation is not discussed in the IRIS assessment (USEPA 1988), has not been peer-reviewed or substantiated in any other document, and is inconsistent with more recent regulatory and public health agencies' positions.

Key issues identified with Mn tap water RSL are:

1. EPA FS inconsistent on need and basis for Mn PRG
 - a. EPA FS Table 2.2-3a (Basis for Portland Harbor COC Selection by RAO and Media) indicates that Mn was added as an outcome of the risk assessment for groundwater for RAO 4 (thus this would be the Baseline Human Health Risk Assessment; BHHRA). The BHHRA does not identify Mn as a human health risk and therefore, this is not correct and not consistent with EPA FS Table 1.2-2 (Chemicals Potentially Causing Unacceptable Risk for Human Health). Therefore, Mn should not have a PRG for RAO 4.
 - b. For RAO 4 (human-health risk related the migration of contaminated groundwater), EPA FS Table 2.2-1a Summary of Portland Harbor PRGs by RAO and Media) lists the PRG for Mn at 430 $\mu\text{g/L}$, a number which correlates to the

EPA RSL for resident tap water use. This approach is consistent with Table 2.1-1 (Chemical Specific ARARs for Remedial Action) which lists EPA RSLs for protection of drinking water as a “to be considered” criteria. However, this is inconsistent with Table 2.2-7 (RAO 4 PRG Derivation) which indicates the PRG for Mn is a risk-based value and not an ARAR or TBC. Based on the number on Table 2.2-1a, we believe EPA is considering the RSL as a TBC and the basis for its RAO 4 PRG for Mn

2. For Mn, the RSL-based PRG set forth in the EPA Proposed Plan is derived from an incorrect and unsubstantiated, un-peer-reviewed, interpretation of the Mn EPA IRIS assessment and is not appropriate as a PRG.
 - a. As discussed above, we believe the RAO 4 PRG for Mn is based on the EPA RSL for resident tap water use, based on a hazard index of 1 (USEPA 2016). The assumptions used for the intake and toxicity for the RSL is an EPA Region-specific manipulation of the oral reference dose (RfD) from the EPA IRIS assessment (USEPA 1988). The EPA RSL table re-calculates the RfD by subtracting out a person’s entire dietary intake of Mn. The underlying basis for this revised RfD is flawed and inappropriate and is inconsistent with more recent analyses of risk to humans from oral Mn exposure.
 - b. The EPA IRIS RfD (0.14 mg/kg-day) was set to protect against adverse effects of Mn from all sources, including diet, and is based on a food study with no observable adverse effects at a human chronic ingestion level of 10 mg/day, equivalent to 0.14 mg/kg-day for a 70 kg human. As noted within the IRIS assessment, “when assessing exposures to manganese from food, the modifying factor is 1; however, when assessing exposure to manganese from drinking water or soil, a modifying factor of 3 is recommended.” When a non-diet modifying factor of 3 is applied to the RfD, a revised RfD of 0.047 mg/kg-day is derived. Nowhere within the IRIS assessment does EPA recommend that the dietary contribution from the normal U.S. diet be subtracted when evaluating non-food exposures. In fact, the User’s Guide for the EPA RSL table specifically says that this recommendation is from the “author of the IRIS assessment” but not from the peer-reviewed and formal IRIS assessment itself.
3. EPA guidance (USEPA 2003, 2009) stipulates that the selection of toxicity information for deriving risk-based screening levels should be based on an evaluation of the scientific quality and rigor of the underlying toxicological studies and the extent of peer review, with priority given to studies that are the most current, transparent, and peer-reviewed.
 - a. The EPA RSL derived using an RfD of 0.024 mg/kg-day should not be used, as it includes a non-standard methodology that is inconsistent with the IRIS file, and

has not undergone peer-review. The EPA guidance documents including *Human Health Toxicity Values in Superfund Risk Assessments*, Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-53, December 5, 2003, and *Risk Assessment Guidance for Superfund: Volume I – Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment)*, Office of Superfund Remediation and Technology Innovation, 2009, establish a hierarchy of sources for determining the appropriate toxicity values to use when making cleanup decisions. These EPA guidance establish as basic criteria currency, transparency, peer review and public accessibility to judge and choose among toxicity sources. IRIS values are the preferred source of toxicity values, and generally if an IRIS value exists it should be used, but if other sources are more recent, credible, relevant, and peer-reviewed, they should also be considered. This guidance has also been reaffirmed in the Environmental Council of the States 2007 white paper *Identification and Selection of Toxicity Values/Criteria for CERCLA and Hazardous Waste Site Risk Assessments in the Absence of IRIS Values*. (ECOS 2007). Given that the EPA Region's derivation of a new RfD for Mn is not recommended in the IRIS assessment and has not undergone peer-review, it is not an appropriate source of toxicity information for Portland Harbor cleanup. Additionally, as described below, there are more recent, credible, and peer-reviewed sources of information for the Mn RfD for non-dietary exposures.

4. A PRG is not needed or appropriate for manganese for RAO 4 because groundwater RAOs are not appropriate as discussed in the EVRAZ comment letter and because it is not identified as a risk in the BHHRA. If a value were appropriate, it should be based on an appropriately calculated risk-based number.
 - a. RSLs are chemical specific concentrations that utilize conservative exposure (intake) parameters. RSLs are not default cleanup levels for use later in the remedial process. If contaminant concentrations exceed their respective RSLs, site-specific assessments are done to provide a data-driven and site-specific assessment of the site's cumulative risk. The assessment should include comprehensive technical evaluation of site conditions, such as background concentration and chemicals and site-specific hydrogeologic conditions that impact the speciation and bioavailability of certain chemicals.

Additionally, as stated in EPA guidance, the most recent, credible, and peer-reviewed toxicity information should be used when assessing risk and determining final RAOs at contaminated sites (USEPA 2003, 2009).

REFERENCES

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ATTACHMENT 3

COMMENTS ON PORTLAND
HARBOR RI/FS APPENDIX H: EPA
REVIEW OF EXISTING AND
HYDRODYNAMIC AND SEDIMENT
TRANSPORT MODEL

Comments on Portland Harbor RI/FS Appendix H: EPA Review of Existing and Hydrodynamic and Sediment Transport Model

Comments on EPA FS Appendix H

Below is a summary of the type of comments EPA presents in Appendix H on model performance:

- Comments that stem from EPA confusing an old version of the HST model domain with the final version.
- Comments that contain general statements without substance.
- Issues that are not a problem with the model, but rather scenarios that EPA would have liked to see and that would only require EPA to have requested them during past discussions.
- Longstanding model characteristics that were not mentioned before and were included in the version EPA accepted in 2010 as mentioned in the summary of EPA's engagement in Appendix H.
- Model limitations whose effects on the results cannot be demonstrated as significant.

These comments do not warrant discarding the model as a line of evidence. Generally speaking, it seems to be malicious intent to present the model limitations out of context of the right use of it.

It should be noted that the entire analysis presented in Appendix H.2 about the performance of the model at the cell level is disingenuous. All models have limited capacity to provide good results at the grid resolution level simply due to the numerical construction. Model results should be analyzed in spatial scales that encompass several grid cells.

Presented below in this section are the responses to each of the key shortcomings identified by EPA in Appendix H.

1. The extent the model domain extends into the Columbia River

"The current model grid extends into the Columbia River approximately 1,000 feet up and downstream of the confluence with the Willamette River. In order to correctly model surface water and sediment transport at the confluence of the Willamette and Columbia Rivers or to model the condition in which the Columbia River backs up into the Willamette River, the model domain should extend to a point near the confluence of the Columbia River and Multnomah

Channel near St. Helens, Oregon.”

This comment states that the model domain should extend to a point near the confluence of the Columbia River and the Multnomah Channel to adequately represent the interactions between the Multnomah Channel, the Columbia River, and the Willamette River. While extending the model domain is certainly a way of improving the representation in this area, this is not the only modeling solution. The hydrodynamic behavior can be adequately represented by using the right boundary conditions in the Columbia River. This was verified by a hydrodynamic recalibration completed by EVRAZ where the model is now able to match the ADCP measurements in the lower 3 miles of the Willamette River where this interaction takes place. A re-parameterization of the hydrodynamic model would have sufficed to provide much better results and is no reason to discard the whole model. Moreover, it can also be demonstrated that this boundary representation is not a model shortcoming as it only affects the lower 3 to 4 miles of the model and the impact is not significant to the study area.

2. Failure to consider bedload transport

“The physical CSM for the lower Willamette River presented in the Revised Phase 2 Recalibration Results (West Consultants and Tetra Tech, Inc., 2009) emphasizes the importance of bedload transport and notes that approximately half the sediment transport from upstream into the Study Area (RM 1.0 to 11.8) occurs via bedload, and notes that a downstream decrease in bedload is important to deposition in the Study Area. Due to the importance of bedload induced sediment deposition within the Site to natural recovery processes, the failure to incorporate bedload into the HST model is a major omission that calls into question all results based on the sediment transport modeling.”

The Revised Phase 2 Recalibration Results (WEST Consultants and Tetra Tech 2009) does not contain a description of a Conceptual Site Model (CSM), so it is not clear where the importance of the bedload is emphasized. It is, however, true that the sediment transport model developed by WEST and Tetra Tech and presented in that report contained bedload as part of the transport mechanisms, whereas the newer and final version developed by Anchor QEA does not. This is because the two model domains are different and therefore require different analysis. The WEST and Tetra Tech model extended up to the confluence with the Clackamas River at RM 24.1, while the Anchor QEA model extends only up to RM 13 where the Morrison Bridge is located. The main reasons for this change in model domain were 1) the best sediment load information is located at the Morrison Bridge as there is an USGS station with data since 1974, and 2) the study area is from RM 11.8 to RM 1.9 so the simulation of sediment transport upstream of RM 13 can only introduce errors without providing helpful results.

The change in domain described above also changed the sediment transport problem. Upstream of RM 16 the bed is predominantly non-cohesive and therefore bedload is a key process. The WEST and Tetra Tech model included bedload as it was relevant to their domain. Below RM 16, however, more fine sediment is found, and below RM 11 only scarce patches of non-cohesive sediments exist. The Anchor QEA model domain is predominantly a cohesive bed. Therefore, inclusion of a bedload model would have minimal impact on the results.

The WEST and Tetra Tech report states on page 23 that “the bedloads from the Clackamas River are deposited in the Willamette River upstream of Ross Island, where the river bed has several large holes.” This statement confirms that bedload is a key transport mechanism up to Ross Island, but not below it. This statement, combined with the fact that most of the study area from RM 1.9 to RM 11.8 is cohesive sediment, makes bedload not relevant. The fact that the model does not consider bedload is not a model shortcoming as the only load that is important is the suspended load of fine material that contribute to the siltation of the study area.

3. Failure to consider rain-on-snow winter flooding

“These types of floods are particularly important because flows rise rapidly and the supply of fine sediment from upriver is large, leading to the potential for erosion (and downstream export) followed by deposition. The Willamette River typically rises faster than the Columbia River. However, the erosion potential of some winter floods is probably reduced by Columbia River flow management that causes artificially high water levels. Moreover, the fine sediment supply associated with rain-on-snow floods may differ from that which occurs under other conditions.”

This is not a shortcoming of the model as the flow effect of rain-on-snow winter flooding has been considered with the 1996 high flow event, which is a measured event that contains this effect as described. The high rise of the Willamette faster than the Columbia is represented during this flood event. The sediment load during this event is not specifically known, but a sensitivity analysis of this effect could have been easily considered if EPA had required it. The impact of this particular effect to the overall model performance is likely to be of secondary importance.

4. Failure to properly evaluate a 100-flood event

“The model did not properly model a 100-year flow event. Historical data indicates that at 100-year flood volume of 500,000 cfs is realistic. The current model simulated the 1996 flood event which is approximately a 425,000 cfs event.”

This event was modeled because it was the biggest event on recent recorded history and it represents a very high flow event. It also provides a full time series of the flow thus representing the rise and fall of the peak flow in a more realistic manner. Using the peak flow that results from a statistical analysis will require an extrapolation of the time series to make the run more realistic. This comment does not point to any model "shortcoming" as EPA wants to qualify it, but just to an additional scenario that could have been easily done if EPA had requested it.

Even though it is not relevant to the comment itself, it is not clear how EPA derived the 100-year flood peak flow value of 500,000 cfs as there is no reference to the analysis used to reach that value.

5. Model grid and aspect ratio

"The current model used a grid size of 200 m by 25 m, which equates to an aspect ratio of 8. Large aspect ratios are sometimes associated with poor numerical properties. In addition, a 200 m long grid cell is likely to include variable depths and possibly not represent processes well. The effect of large aspect ratios for some of the grid cells on the numerical solution is well known, but has not been quantified for this modeling study. In addition, the use of larger grid cells resulted in more numerical dispersion in the approximate solutions to the discrete difference equations used in the model. Finally, the grid resolution utilized in the model limits the accuracy of mapping of some remedial alternatives onto the model thus decreasing the accuracy of related simulations associated with the evaluation of remedial alternatives in the FS."

The grid dimensions were selected to balance the resolution of the solution with the computational time required to obtain results. Any model grid can be criticized to be too coarse, but in practice a compromise is needed. The model grid has been the same and unchanged for more than 10 years. When "In July 2010, EPA authorized the LWG to go forward with the model" (Appendix H of the EPA FS Report), the model had this grid. Therefore, it is disingenuous to point out the grid as a shortcoming that disqualifies the model at this time in the modeling process. Furthermore, large aspect ratio grids only pose problems when the flow patterns are misaligned with the grid faces. This effect is typically not significant when the flow is largely unidirectional, as is the case for most riverine systems. Therefore, the aspect ratio of the grid is unlikely to have significant impact on the model results. Resolution of the depth was also pointed out as a shortcoming, however, gradients in bathymetry are typically small in the along-channel direction, where the 200 m grid resolution is employed. The depth is more variable across the channel, which is resolved at 25 m. This is precisely why a curvilinear and higher aspect ratio grid is utilized

for river systems because gradients along the channel typically occur over larger length scales.

6. Model Calibration

"The model has not been appropriately calibrated. Separate calibration and analysis periods are needed to fully validate the Environmental Fluid Dynamics Code (EFDC) circulation modeling, with each period being at least a year long and encompassing both flood periods and low-flows. At a minimum, a subset of the longer validation time period should have been used to calibrate and validate the hydrodynamic model."

EPA incorrectly states in this comment that the hydrodynamic model has not been appropriately calibrated. The hydrodynamic model calibration and validation was executed using ADCP measurements performed in 2002, 2003, and 2004 for different flow conditions. As presented in Appendix La, Section 2.2.4 of the LWG RI/FS document (Anchor QEA 2012), the hydrodynamic model results were compared to all of the ADCP measurements using the same model calibration parameters, which therefore fulfills the requirement for calibration and validation of a hydrodynamic model. The request of year-long model calibration and validation periods is infeasible due to the lack of available data and the impracticality of collecting a year long ADCP data in several locations of a relatively wide river like the Willamette. The limited data availability only emphasizes the importance of the model to fill in the significant gaps in available data.

7. Sediment Loading

"The model did not appropriately consider sediment loading. Sediment supply from the Willamette River is a vital boundary condition for the sediment transport and fate and transport models. Only post-1973 USGS sediment concentration and load data for the Willamette River were used, with observations for days with flows up to approximately 200,000 cfs. These data do not include the available larger 1962-1965 daily data set that includes detailed observations for the December 1964 flood, including multiple observations on the days of peak sediment load. The 1964 flood exhibited a peak flow of approximately 443,000 cfs and is one of the four largest Willamette River flood events of the last century. Accordingly, the 1962-1965 data set is an important resource that should have been used. This data set also provides percent sand data, so that the sediment load can be correctly divided into sand and fines transport, and the fines load needs to be divided into silt and clay inputs."

The sediment loading analysis includes more than 30 years of sediment data right at RM 13, which is the boundary of the sediment transport model. The data

of the 3 years from 1962 to 1965 was not available when the model was developed; it is a pity that EPA, knowing of its existence, did not raise the topic before in order to incorporate it to the analysis. It is relevant to say, however, that the addition of this data to the analysis will not necessarily change the sediment load significantly to render it useless, as EPA seems to suggest. The main reason for this is that the additional data represent 3 years, which is less than 10% of the extent of the dataset that was used to develop the sediment load. Also, the additional data is old and represents a time when there were fewer dams in the system. Sediment loading is well represented in the system by using a very long dataset from USGS and it is unreasonable to think that adding less than 10% of additional data will change the results in a way that will invalidate the model.

EPA also noticed some additional problems:

7.1 Hysteresis effects

"The rating curves did not consider sediment load hysteresis, though this is an important factor in the system. Typically, the sediment load is highest on the rising arm of the freshet, which is an important feature of rain-on-snow floods."

While the hysteresis effect is real, the impact of not accounting for it is not necessarily a first order problem of the model. This is a refinement of the model input that could been done if EPA had requested it.

7.2 Sediment quality

"The modeled division of the supply between fines and sand is incorrect for high flows, in part because it did not consider the very large supply of clay material, which is likely most prominent during rain on snow floods."

It is not clear what analysis resulted in this statement from EPA that the division of the supply is "incorrect." The division between fines and sand has resulted from available data provided by USGS and with an analysis presented in Appendix La of the LWG RI/FS Report (Anchor QEA 2012). Therefore, it is not acceptable to discredit that analysis with a general statement with no supporting data analysis to explain why the division of class sizes is wrong.

7.3 Lower Willamette River deposition and erosion

"The sediment load measured at the Morrison Street Bridge does not represent the load to the lower Willamette River because those

measurements are affected by deposition and erosion between Oregon City and Portland Harbor. It is likely that the load during low flow (depositional) periods is underestimated, while the load during high flow periods may be overestimated. The correct use of the Morrison Street Bridge data and rating curve is for validation of the model predictions, not as a boundary condition, because the sampling is within the system rather than at the boundary. This problem can only be remedied after collection of an appropriate data set at Oregon City."

As explained for bedload transport comment (item 2 of this section), the LWG model domain does not include the sediment transport upstream of RM 13 where the Morrison Bridge is located. These measurements are at the boundary and not within the system as EPA states. It is valid to say that the measurements at RM 13 are not representative of the river sediment load to the Lower Willamette River as a whole (meaning from RM 26.6 downstream of the Willamette Falls). However, the measurements are representative of the sediment load traveling towards the study area, which is the main reason to use it. Again, this comment from EPA seems to stem from confusion about the model domain, and is simply incorrect.

7.4 Columbia River sediment loading

"The Columbia River sediment load at Vancouver was set based on 1963-1969 data. While a reasonable first step, the percent sand was underestimated. Information in Haushild et al. (1966) should be used to set the percent sand as a function of flow. Also, post 1973 USGS NWIS should have been used, as was done for the Morrison Street Bridge"

Haushild et al. (1966) provide some information that could have been used to set the sand percentage on the sediment load from the Columbia. It is regrettable that EPA did not point this out before, as this would have been an easy add-on to the existing analysis. It does, however, have limited impact on the site as the Columbia River can mainly transport sediment in the Willamette River up to the Multnomah Channel (around RM 3) and from RM 3 to RM 1 the river has a cohesive bed that indicates sand is not transported there.

EPA refers to the use of USGS NWIS to get sediment information, but the closest station with sediment information (Warrendale, OR) is located more than 35 miles upstream of the model boundary conditions. This dataset could not be combined with the one collected at Vancouver, WA, which is much closer to the boundary and was used to develop the sediment load rating curve.

8. Settling Velocities are inappropriately represented

This comment was not reproduced as it is too long, but this comment references the equation from Burban et al. 1990. This equation has long been in use to calculate the settling speed of flocs in freshwater and is still regarded as state of practice today. The equation, referenced in Appendix H, is:

$$W_s \text{ (m/day)} = 3.3(C_1 G)^{0.12}$$

The measurement of the behavior of clay, silt, and the flocs they form by Burban et al., lead to the conclusion that the settling speed was higher when the column shear stress was higher for the same concentration. This is because the higher turbulence associated with the higher shear stress produces more interaction between silt and clay particles and therefore more flocs. It is unclear then why EPA says that it is "unrealistic" that the settling speed tends to zero when there is less shear stress. That effect was the one observed in this peer-reviewed study of flocs behavior so it certainly is realistic. It is true that other sediment that do not floc will settle faster with slack waters, but this is not the case for flocs as observed by Burban et al.

In general, the flocculation of cohesive sediments in the water column is an active area of research and there is no widespread consensus on the best model that capture the whole behavior of this process. This parameterization provides a reasonable estimate of flocculation effects given the uncertainty. Uncertainty in particle flocculation is not grounds for discarding a model due to the high uncertainty in even measuring the effect. And it is unlikely that modifications to the parameterization will lead to significantly different sedimentation results although a sensitivity to the flocculation parameters could have been conducted if requested.

EPA also mentions the effect of the horizontal gradients of shear stress and concentrations on the settling speed. The model is considering this gradient at the grid cell resolution level. It is correct that at each calculation step a portion of the water moving from one cell to the next experience a relatively sudden change on its settling speed based on the different condition of the destination cell compared to the origin cell as equilibrium is assumed. This is true not only for this parameter, but for all parameters used in the model and is a typical assumption in modeling studies.

The effect of the equilibrium assumption is mitigated to prevent unrealistic numerical effects with the use of a low Courant number for the advection dispersion equation. Experience has shown that in most cases the equilibrium assumption provides reasonable results, but in certain circumstances the errors of this assumption could be important enough and a kinetic approach is needed.

The analysis of the relevance or not of the equilibrium assumption could have been conducted if EPA had raised the issue, as this equation has been used since 2009 and presented multiple times. This EPA comment is not only untimely, but it implies that the effect of the equilibrium assumption is relevant to the results without providing any supporting evidence.

9. Hydrodynamics and sediment transport are not properly linked

"The EFDC hydrodynamic model and the SEDZLJ sediment transport model are not coupled to allow changes in bed elevation (due to deposition and erosion) predicted by SEDZLJ to be used to update the flow field predicted by the hydrodynamic model during the next time step. Under some circumstances, e.g., in water bodies with minimal morphologic changes over the period of model simulation, this will not cause major problems in the modeling, and it is a useful simplification for long simulations. However, erosion of up to 1 m during severe flood events may occur, resulting in a change in the hydrodynamics. In addition, the uncoupled model used resulted in unrealistic amounts of deposition in certain reaches of the river since the decrease in the flow depths caused by the predicted increase in bed elevations in these depositional areas was not reflected in the hydrodynamic model. The impacts of this simplification to the model framework should be judged using fully coupled runs for comparison. Impacts of this simplification also need to be considered in sensitivity analyses. The impact of this simplified model framework on the results from the contaminant transport and fate model also needs to be fully evaluated."

Anchor QEA performed a sensitivity analysis on the impact of not having a fully linked model and presented this to EPA. This sensitivity showed that the impact was not as significant as predicted by EPA. The model results or a formal document from ERDC with a fully coupled model were not provided so it was not possible to analyze if the differences they observed were a result of the model linking or some other aspect of the linking methodology and/or changes to the code. The effect of the morphology on the hydrodynamics depends on the change in bed elevation to the depth of the water column. While a 1 m change in the bed elevation may be significant for a very shallow system, large portions of the Willamette River are 30-60 m deep and the change in morphology is unlikely to have a significant impact on the model results.

10. Underestimation of uncertainty in the model

"While the sensitivity analysis recognized the importance of sediment loading, no other sources of uncertainty and bias associated with the hydrodynamic and sediment transport modeling were recognized. The result is that uncertainties are far higher than reported."

This statement is simply incorrect as there was no attempt to do an uncertainty analysis in the presented model. A complete uncertainty analysis requires the investigation of the expected value and its variability for each of the inputs and parameters of the model. Then, the model algorithm needs to be applied to the whole distribution of inputs either by using an analytical method (i.e., using the equations derivatives) or a numerical method like Monte Carlo.

Given the complexity of the equations, the analytical method is not practical. The Monte Carlo analysis is also not practical as it would require a very long computational time to run the model with all the potential input distribution. Furthermore, the distribution of the inputs is not known, complicating things further and making the uncertainty analysis itself very uncertain. In fact, EPA even acknowledges in their Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (Section 2.9.5) that uncertainty analysis of numerical models is not possible and practical at this time (USEPA 2005).

Because of the aforementioned reasons, the evaluation of the reliability of the model was done using a sensitivity analysis. This analysis focuses on analyzing the impact of certain key variables on the model results and also provides bounds of the potential results. The objective is twofold: 1) to understand how a variation on an uncertain input could affect the model results relative to other inputs and 2) to obtain an upper and lower bound to the model results. The first objective allows concentrating the future modeling and sampling efforts on variables that have the highest impact on model results. The second objective allows for characterizing the potential spread of the model results.

EPA also incorrectly mentions that no other input was analyzed besides sediment load. The sensitivity analysis, as described in Section 2.3.7 of Appendix La (Anchor QEA 2012), was performed for the following inputs:

- *Upstream sediment load in Lower Willamette River: \pm a factor-of-two with respect to base-case simulation*
- *Upstream sediment load in Columbia River: \pm a factor-of-two with respect to base-case simulation*
- *Composition of upstream sediment load in Lower Willamette River: \pm 5% class 1 content with respect to base-case simulation*
- *Erosion rate parameters for cohesive sediment: lower-bound corresponds to least erodible core and upper-bound corresponds to most erodible core*
- *Effective bed roughness: mean \pm 2 standard errors*

So, in addition to the sediment load, the bed roughness and the erosion rate parameters were also used for the sensitivity analysis.

11. Improper model validation

"The validation of the sediment transport model rested entirely on attempts to reproduce observed 2003 to 2009 erosion and deposition patterns, a time period without a major flood. This approach is inherently ambiguous and incomplete. It is not possible to know whether the right answer has been reached for the wrong reasons, even if the bed changes are plausible for this time period. For example, if a model and data agree that an area shows no net erosion or deposition over a time period, this does not make the model correct, because erosion and deposition cycles and events that profoundly affect contaminant transport may not have been modeled correctly.[...]"

At the time of LWG model calibration, there were no other available targets than the bed elevation changes from bathymetries, and therefore this is what was used to calibrate the model. If other data existed or had become available in the future, the model could be corroborated. It is correct that hitting two points in time does not explain how sediment moves in between, but that is what EPA is proposing when using just two points in time as a line of evidence for the whole system design. Moreover, the LWG model is embedded with proven algorithms that have been used in many past studies and that explain the processes for erosion, deposition, and transport. The model is a more reliable prediction tool than simply guessing that an area is depositional because the bed elevation change is more than an arbitrary value in that area.

"[...]Further, as noted above, the Willamette River sediment load is incorrectly considered and bedload transport has been neglected. Thus, it is likely that the model's success is based on incorrect parameterizations, calling into question its predictive ability.[...]"

As presented under Item 2 and Item 7 of this document, the model is not incorrectly parameterized. Bedload is not a factor in the study area and the sediment load is not wrong.

"[...] Given the difficulties documented above in the hydrodynamic and sediment transport models, it is vital that SEDZLJ water column transport predictions be tested against measured data. While further data collection is needed, there are readily available data sets that have not been used, such as the 2009-2014 USGS time series of turbidity at the Morrison Street Bridge. Acoustic backscatter data or ABS (better for coarser sizes) and side-looking acoustic Doppler current profiler (ADCP) data could be obtained from the Morrison Bridge gauging station. Both time series should be calibrated, considering variations in both particle size and concentration."

This paragraph continues to demonstrate EPA's confusion on the current model domain. This comment suggests using data at the boundary of the model for validation. This is of course incorrect, as data collected at a certain location cannot be used as boundary condition and as validation target at the same time.

Section 3: Comments on EPA's line of evidence approach

EPA introduces the lines of evidence used to evaluate the MNR alternative in the EPA FS (Section 4.1.2). Analysis of the lines of evidence is then presented by EPA in Appendix D8, where they discuss the first line of evidence is to just use the bathymetric difference between 2003 and 2009. Depositions or erosions that are more than 2.5 cm/yr are considered real as they are bigger than the uncertainty of the bathymetric survey itself (± 0.5 ft in approximately 6 years yields 1 in/yr or 2.5 cm/yr). However, as EPA expressed in the FS Section 3.6.1.2:

"One of the limitations associated with using bathymetric survey pairs to estimate sediment deposition is that the surveys are a "snapshot" in time and may not represent the dynamic nature of the sediment bed over time."

To account for the variability over time, EPA creates another line of evidence that is termed the consistency of erosional and depositional processes using 10 pairs of bathymetries and calculating the bed elevation changes between them. As EPA states in Section 3.6.1.2:

"Four types of results were generated:

- Consistently erosional: all 10 pairs were either neutral or >2.5 cm/year;*
- Consistently depositional: all pairs were either neutral or <-2.5 cm/year;*
- Consistently neutral: all pairs were between -2.5 and $+2.5$ cm/yr; and*
- Dynamic equilibrium where there was a mix of results."*

This analysis disregards the uncertainty on the surveys, which is 15 cm as pointed out above. Four of the 10 pairs span less than a year, so errors of more than 15 cm/year are possible. Judging all pairs using the same sedimentation rate may introduce errors. For example, for one pair with a shorter than a year timespan, an erosion of 2 cm is now transformed into an erosional zone when annualized, while the change is well within the uncertainty and in reality could have been even depositional. It is not clear what is the impact of mixing different uncertainty levels, but it should have been analyzed to ensure that this line of evidence is actually providing some insight on the variability of the reality and not just measuring the variability of the uncertainty of the bathymetry surveys.

Once completed, the line of evidence analysis was summarized in Table D8-3, where a score of "0" indicates a neutral area and "-1" indicates erosion is likely.

Table D8-3
Summary Score for Evaluation of MNR
Portland Harbor Superfund Site
Portland, Oregon

SDU	Average Score by Alternative						
	A	B	D	E	F	G	I
RM 2E	0	0	0	0	0	0	0
RM 3.5E	0	0	0	0	0	0	0
RM 4.5E	0	0	0	0	0	0	0
RM 5.5E	0	0	0	0	0	0	0
RM 6.5E	0	0	0	0	0	0	0
Swan Island	0	0	0	0	0	0	0
RM 11E	-1	-1	-1	-1	0	0	-1
RM 3.9W	0	0	0	0	0	0	0
RM 5W	0	0	0	0	0	0	0
RM 6Nav	-1	-1	-1	-1	-1	-1	-1
RM 6W	0	0	0	0	0	0	0
RM 7W	0	0	0	0	0	0	0
RM 9W	0	0	0	0	0	0	0
No SDU	0	0	0	0	0	0	0

This table shows virtually no difference along the river as all SDUs (except two) score "0." This approach provides virtually no discrimination among areas of the river, which is clearly ill-designed for a river with so many identifiable areas that behave differently. This methodology seems to average so much that there are no possible distinctions between areas and everything is meddled together in a great "no change" area spiked with some known erosional areas. Most of the averaging happens because the bathymetry uncertainty drives use of a deposition rate that is way higher than needed for MNR to be successful. The full methodology should be revised and the model should be added to the lines of evidences to ensure a better representation of the MNR processes.

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ATTACHMENT 4

RM 2-3 SWAC ANALYSIS



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ATTACHMENT 4

Subject: Evaluation of RM 2–3 PCB SWACs

We investigated the calculation of PCB spatially weighted average concentrations (SWACs) used in EPA's selection of the Preferred Alternative in the SDU 2E and in the segment of Portland Harbor from river mile 2 to 3. Our analysis investigated two key topics essential to EPA's calculation of remedial alternative effectiveness:

- The area over which post-remedy concentrations were calculated
- The effect of natural recovery.

Surface sediment data developed for five chemicals (total PCBs, tPAH, DDx, and two dioxin/furan congeners) were interpolated by EPA using the natural-neighbors method. The interpolated data are stored in GIS in a raster file; each 10 ft by 10 ft cell is associated with a concentration. We exported the surface sediment concentration of the five chemicals for each raster cell between river mile 2 and 3 to an Excel file. In GIS, we intersected each raster with vector (polygons) GIS data for the remedial alternative footprints (yes/no whether cell is dredged/capped), river mile (to tenths of a mile), side of river (east, west, navigation channel), and region of river (shallow, nav-fmd, or intermediate), and these fields were included in the Excel file. The GIS files of the interpolated sediment data and remedial alternative footprints had been provided by EPA to LWG through a FOIA request on the Draft (2015) FS.

Lastly, an interpolation of total organic carbon and percent fines is part of the GIS data set for the Remedial Investigation, and we exported these values to the spreadsheet. Because each raster grid cell (or row in the spreadsheet) represents the same area (10' x 10' surface area) a SWAC can be calculated simply as the average of the concentrations in the grid cells

of interest, and average concentrations calculated in the spreadsheet were used to investigate post-remedy PCB SWACs.

Perceived effectiveness is affected by the area over which the SWAC is calculated.

We calculated post-construction PCB SWACs within SDU 2E and across the entirety of the river mile 2 to 3 area. Because fish do not necessarily live within or are not necessarily caught within an SDU, a whole river mile average is a more appropriate exposure area for averaging. Further, a river mile wide SWAC is comparable to the manner in which sediment and tissue data were paired in the Food Web Model (the relationship between PCBs in tissue to PCBs in sediment is based on sediment data within a river mile of the fish collection location).

EPA's calculation of SWACs (and thus, risk) on an SDU basis, instead of on a river mile basis, overstates the post-construction risks. Further, these risk reductions don't reflect appropriate exposure areas. The SWACs are dependent upon the area over which the SWAC is calculated. In the table below, the remediation footprint is the same for each row, but the SWAC was calculated in SDU 2E only or across all of the sediment from river mile 2 to river mile 3. The table shows that a cleanup in the Alternative B footprint gets a better benefit (lower SWAC) across river mile 2 to 3 than an Alternative E (preferred alternative) cleanup yields when the SWAC is constrained to SDU 2E.

EPA uses SDU-based SWACs to select its Preferred Alternative (Alternative E), but the same (or better) benefit can be achieved by Alternative B when the appropriate exposure area is used for calculating the SWAC.

Averaging Area	PCB SWAC in $\mu\text{g/kg}$ (replacement value = $9 \mu\text{g/kg}$)			
	Alt A	Alt B	Alt D	Alt E
SDU 2E	235	66.3	47.1	37.2
RM 2-3	76.7	32.5	27.5	24.8

Consideration of natural recovery affects long-term effectiveness.

Because EPA's evaluation of alternatives utilizes an unrealistic assumption of a zero replacement value with sediment persisting in a static state into perpetuity (no calculation of changes in sediment concentrations over time), we used a rough approximation method to estimate future SWACs for Alternatives B, D, and E, taking into account natural recovery processes following and during construction. This example is for demonstration purposes -

to show the effect when one considers natural recovery following the RI/FS data collection period and during a reasonable time frame post-construction. We used a simplified version of the Lower Duwamish Waterway (LDW) FS bed composition model (BCM), which is:

$$C_{\text{(time)}} = C_{\text{bed}} * f_{\text{bed}}(\text{time}) + C_{\text{lateral}} * f_{\text{lateral}}(\text{time}) + C_{\text{upstream}} * f_{\text{upstream}}(\text{time})$$

Where:

- f_{bed} , f_{lateral} , and f_{upstream} are, respectively, the fractions of surface sediment sourced from existing bed sediment, lateral source sediment, and upstream sediment in each grid cell at a specific point in time. The sum of these fractions in each grid cell is 1. For the LDW FS these fractions were derived from a sediment transport model.
- C_{bed} , C_{lateral} , C_{upstream} are the concentrations of a COC associated with each sediment source. In the LDW FS, these concentrations are from existing bed sediment concentrations (or a replacement value in remediated areas), lateral source samples (i.e., stormwater and CSO discharges), and upstream lines of evidence.

In our simplified exercise, the percent fines (sediment with a grain size smaller than 63 μm) in the surface sediment was used as an indicator of recovery potential. Percent fines was assumed to be related to the proportion (by mass) of the sediment sourced from upstream in each 10-year period as follows:

Percent fines	Amount of sediment (fraction of mass) from upstream in each 10-year period
<50	0
50-60	0.5
60-75	0.6
>75	0.7

The concentration associated with upstream sediment was assumed to be 20 $\mu\text{g/kg}$ (equilibrium) in the first and second 10-year periods and 9 $\mu\text{g/kg}$ (EPA's background value) in the third 10-year period. Our equation ignores potential contaminant contributions from outfalls, so the f_{lateral} and C_{lateral} variables drop out of the equation, and the fraction of sediment from upstream plus the fraction of sediment from the bed add up to 1.

The first recovery period (identified as year 10) is an assumed recovery of sediment that has been occurring since the RI/FS data were collected. All alternatives have the same SWAC value because no construction has yet taken place. An upstream-sourced sediment concentration of 20 µg/kg was assumed. The original bed concentration is the natural-neighbors value from EPA's draft FS.

The second recovery period (identified as year 20) is assumed to occur during construction. The dredged and capped cells were assigned a replacement value of 9 µg/kg, and the formula above was applied to the other cells. An upstream sediment concentration of 20 µg/kg was assumed. The bed concentration in the un-remediated cells come from the year 10 estimates. Dredge residuals were not considered, but could be in a future analysis, balanced by deposition from upstream.

The third recovery period (identified as year 30) used the year 20 outputs as the original bed concentration and an upstream-sourced PCB concentration of 9 µg/kg (assuming decreasing inputs both due to source control and to less upstream dredging over time). This evaluation assumes that:

- All construction is completed within the second 10-year time period and dredged/capped areas reflect the replacement value (9 µg/kg) at the end of the time period
- That dredge residuals do not contaminate nearby areas
- The upstream inputs decrease over time from 20 to 9 µg/kg
- The concentrations in any cells already below the upstream value will not increase. The concentrations in these cells were held constant.

PCB SWACs (µg/kg) in RM 2-3	At Completion of RI/FS Data Collection	Recovery between FS and Remedial Action Implementation	Remedial Action Implementation (construction) + Recovery	Additional 10 years of Recovery
Example time period (years)	0	10	20	30
Alt A	76.7	51.8	43.5	36.5
Alt B	76.7	51.8	20.6	15.4
Alt D	76.7	51.8	18.8	14.0
Alt E	76.7	51.8	18.2	13.7

This evaluation demonstrates that Alternative B is just as effective as the larger alternatives when ongoing upstream sources and natural recovery processes are considered.

Conclusions

Alternative B is defensible and provides the same protectiveness as EPA has cited for the Preferred Alternative. This is due to:

- SWACs calculated across the appropriate exposure area demonstrate that the risks are not as great as reported in the FS and that Alternative B achieves the appropriate level of protectiveness.
- A lower starting SWAC, owing to the recovery occurring over the RI/FS/PP/ROD timeframe (recovery to ROD above), shows that the risks are not as great as reported in the FS.
- Natural recovery results in no meaningful difference from Alternative B to Alternative D (and by extension to the Preferred Alternative I/Alternative E).

ATTACHMENT 5

REDLINED EPA TECHNOLOGY ASSIGNMENT MATRIX AND DECISION TREES (PROPOSED PLAN FIGURE 10)

This should allow for more flexibility in assessments of recovery potential in the design phase. Suggest rewording as "Amenable to recovery (e.g., depositional or subsurface:surface ratio >2)?"

This matrix should not be used. It should be replaced with Figure 10e.

Note: This figure was not included in the Proposed Plan; however, the intermediate areas flow chart suggests that it is used to assign technologies. There are numerous issues with the screening criteria and ranking scheme in this matrix, some of which are highlighted below.

Technology Assessment & Scoring		Dredge	Armor Cap	Cap
Hydrodynamics	Wind/Wave Zone?	1	0	NC
	Erosive?			-1
	Depositional? (>2.5 cm/year or Subsurface:Surface Ratio >2)?	-1	1	1
	Shallow?	1	-1	0
Sediment Bed	Slope 15-30%?	1	1	NC
	Slope >30%		0	
	Rock, Cobble, Bedrock Present?	-1	1	1
	Structures/Pilings?	-1	1	1
	Prop Wash Zone?	1	0	NC
	Moderate or Heavy Debris?	-1	0	1
Technology Score		Sum Scores for Each Technology		

"Armored Cap"

"Engineered Cap"

Scoring

1 = Favors application of technology

0 = Neither favors nor limits technology

-1 = Limits application of technology

NC = Not considered an appropriate technology for this condition

We suggest deleting this row because the outcomes from this decision matrix are only applied in the intermediate areas. However, suggested edits to Figures 10a and 10c suggest the addition of a matrix designation column.

For questions answered "yes", sum scores from that row for each technology (column).

Suggested minimum footnotes for table use:

1. This matrix was developed to support preliminary technology assessment and selection for FS/PP purposes. Alternative technologies may be considered in coordination with EPA during remedial design based on site-specific engineering evaluations such as the nine dredging and capping demonstration criteria identified in Figure 10e.
2. The questions above are asked for each river grid cell. If the response is "yes" the score for that row is assigned for each technology. Where the response is "no", the criterion is ignored (or the score in that row is 0 for each technology). For each question answered "yes" the scores in that row are summed for each technology (summed down each column). The technology with the highest total score is the designated technology carried forward to the Technology Assignments for Intermediate Areas flow chart for FS/PP purposes.
3. This technology scoring is intended to identify potentially representative technologies for FS/PP analyses subject to more rigorous site-specific evaluations performed during remedial design. Lower scoring technologies are not precluded from consideration during remedial design but will need to be justified based on site-specific dredging and capping demonstration evaluations. The preferred technology from this matrix is applied in the blue diamonds in the column titled "Matrix Designation".

Figure 3.4-16. Multi-Criteria Decision Matrix

GLOBAL COMMENTS FOR ALL TECHNOLOGY ASSIGNMENT CHARTS:

- o Should allow capping if authorized navigation depth is at least 5 ft higher than anticipated post-remedy top-of-cap elevation.
- o Should allow partial dredge and cap in nav/fmd areas based on bathymetry.
- o Need footnote clarifying that need for reactive layer, armor, and residual layer to be determined in RD based on site-specific conditions and design performance requirements (see recommended footnotes).
- o Need to address backfill requirements for dredge areas without capping, considering future site use, grading requirements for stability, and habitat considerations.

GLOBAL FOOTNOTES FOR ALL TECHNOLOGY ASSIGNMENT CHARTS

General: Technology assignments presented herein were developed for FS/PP purposes. Alternative technologies may be considered in coordination with EPA during remedial design based on site-specific engineering evaluations completed as part of the nine dredging and capping criteria identified in Figure 10e.

1. Final surface elevation of caps within Nav and FMD areas must be below federally authorized depth, plus provisions for future maintenance depth and navigational buffer (TBD during remedial design) and shall be armored as necessary for erosion protection.
2. Maximum practicable dredge depth to be determined during remedial design, based on site-specific geotechnical considerations, structural offset requirements, and other constraints.
3. The need for and type of reactive amendments for treatment layers, caps, and residual cover TBD during remedial design, based on technology performance requirements, site-specific sediment and groundwater chemistry, and cap modeling.
4. Dredge residuals management procedures such as post-dredge sand covers will be determined during remedial design based on the estimated concentrations of residuals relative to the RALs applied at the applicable depth below mudline. These procedures may include addition of treatment amendments (e.g., activated carbon) to sand covers.
5. Dredging, capping, and backfill should be balanced to the extent possible to minimize net loss of habitat; where not practicable, habitat mitigation may be necessary.
6. Ability to contain PTW-NAPL - NRC to be determined during remedial design based on site-specific engineering evaluations.
7. Technology assignment and selection shall account for the presence of any ongoing, stranded, or uncontrolled upland groundwater plumes. The cap design and modeling runs should appropriately incorporate the in-river conditions created by any ongoing or planned upland groundwater source controls.

Figure 10a: Technology Assignments for Navigation Channel and Future Maintenance Dredge Areas

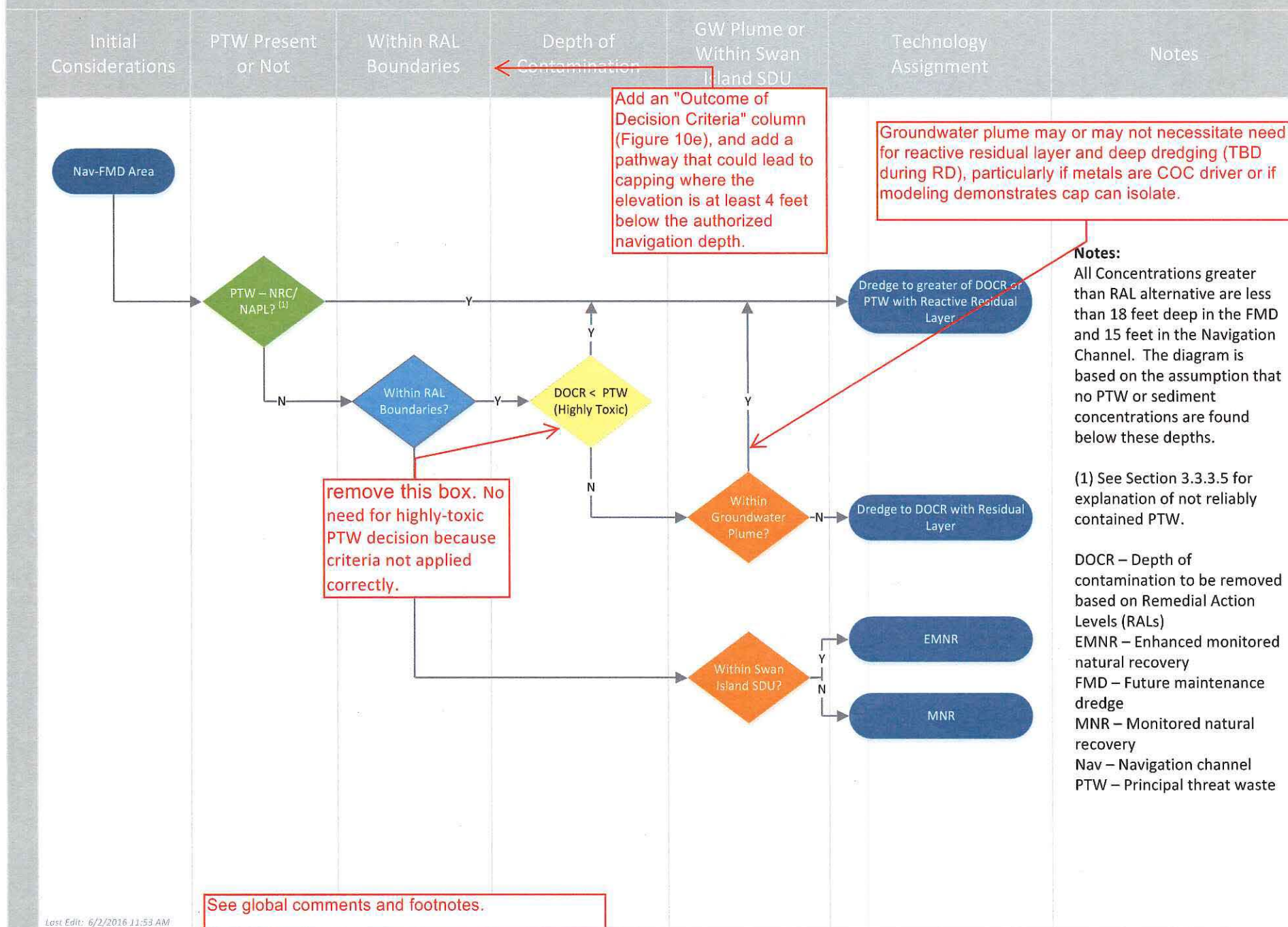


Figure 10b: Technology Assignments for Intermediate Areas

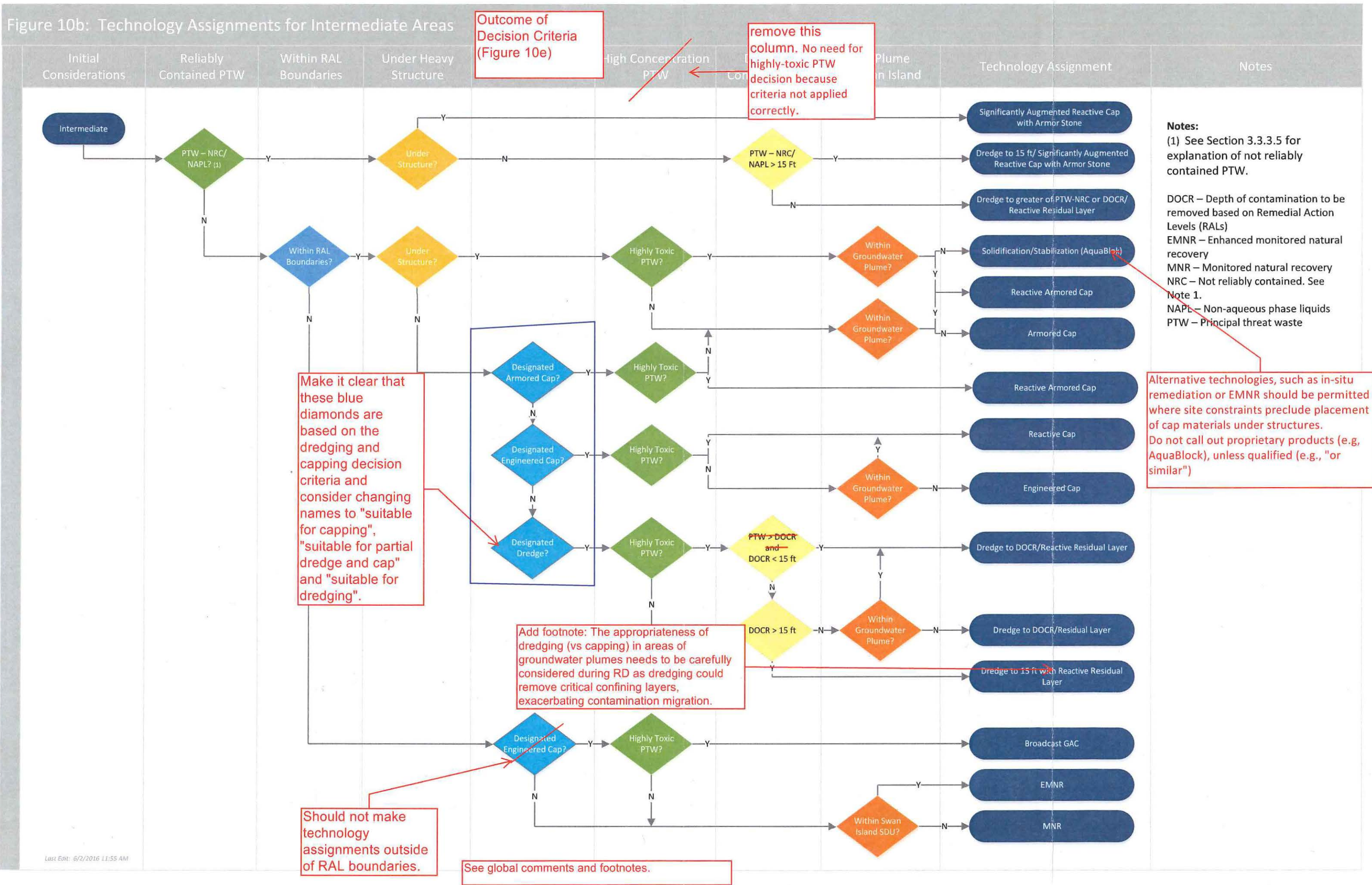


Figure 10d: Technology Assignments for Contaminated River Banks

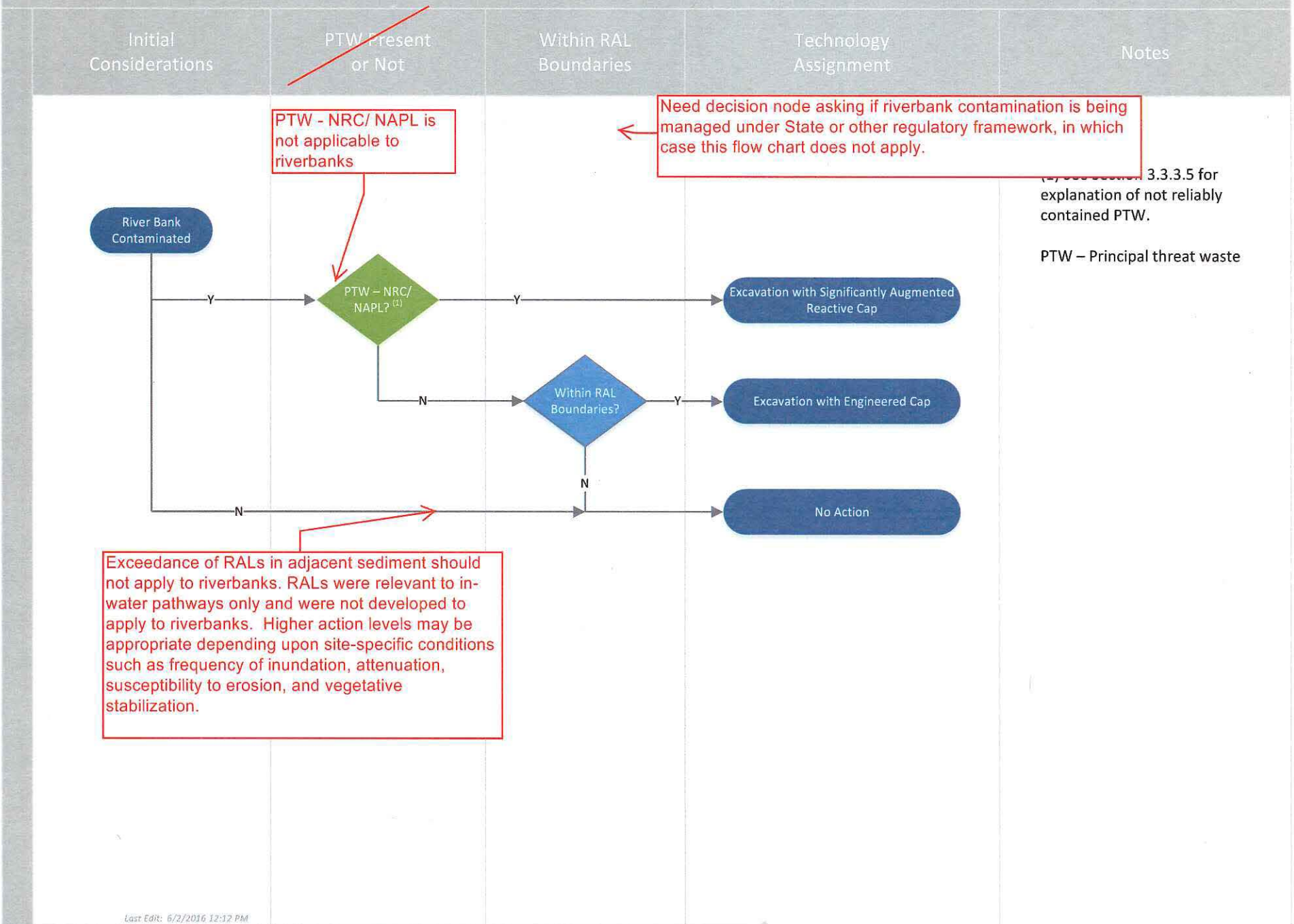


Figure 10e. Dredging and Capping Decision Criteria

Dredging Decision Criteria		Capping Decision Criteria	
Erosion	Demonstrate that erosional effects (from currents, propwash, or wind/waves) will not make dredging infeasible due to high sediment resuspension and release conditions. Demonstrate that any necessary dredge residual covers will not be eroded shortly after placement.	Demonstrate that the cap will remain in place when subjected to current, wave, and propwash induced forces up to a reasonable design condition (e.g., 50-year flow event for currents).	
Deposition	Deposition Dredging may be conducted in high or low deposition rate areas because the contamination will be removed and subsequent deposition rates do not impact dredging effectiveness.	Capping may be conducted in high or low deposition rate areas because caps must demonstrate effectiveness even in zero deposition or erosional conditions (see erosion criterion). Additional deposition on top of a cap only improves the cap effectiveness over time.	
Shallow/ Habitat	Demonstrate that the proposed dredge design will not unnecessarily alter shallow water habitats (or other habitats) in such a way that reduces habitat values (e.g., dredging of shallow areas that converts them to deep water areas). Or alternatively, that dredge habitat impacts are balanced with other remedy features such as: contaminated sediment capping in other areas that increases shallow habitat to the overall remedy, additions of habitat features (e.g., fish mix or other appropriate surface substrates after dredging), compensating on site mitigation, compensating off site mitigation, or other types of habitat impact mitigation.	Demonstrate that the proposed cap design will not unnecessarily alter shallow water habitats (or other habitats) in such a way that reduces habitat values. Or alternatively, that cap habitat impacts are balanced with other remedy features such as: contaminated sediment or riverbank dredging in other areas that increases shallow habitat to the overall remedy, additions of habitat features (e.g., fish mix or other appropriate surface substrates), compensating on site mitigation, compensating off site mitigation, or other types of habitat impact mitigation.	
Steep Slopes/ Geotechnical	Demonstrate that the proposed dredge design can be constructed on any steep slopes and will not cause unstable slopes after dredging including adjacent riverbank and upland areas.	Demonstrate that the cap will remain in place on the existing slope through appropriate design evaluations and additional design features (e.g., keying in the cap at the foot of the slope or using more granular material in some layers) as necessary. This should include evaluating seismic events of reasonable design magnitude. Demonstrate that the sediment bed geotechnical properties will adequately support the proposed cap.	
Rock/cobble/ bedrock	Demonstrate that the dredging can remove contaminated sediments intermixed with any rock, cobble, or hard substrates (e.g., are specialty or small suction dredges needed?) without substantial exacerbation of dredge resuspension and releases.	Capping of contaminated sediments intermixed with any rock, cobble, or hard substrates can be conducted in most cases because placement of sand or similar material is not affected by the presence of such hard substrates. Erosion criterion must also be met if hard substrates occur in high energy areas.	
Debris	Demonstrate that debris can be effectively removed to a sufficient degree that any remaining debris will not substantially hinder the efficient removal and subsequent transloading, transport, and processing (e.g., dewatering/treatment) of the removed sediment. Demonstrate that any remaining debris will not contribute to substantially increased sediment resuspension and contaminant release during dredging.	Demonstrate that the debris does not present a substantial obstruction to effective capping of the area (e.g., such that large voids are not created by overlying timbers or complex debris fields). Or alternatively, that the sufficient debris removal prior to capping is incorporated into the design such that the cap can be effectively placed.	
Flooding	Demonstrate that the proposed dredging plan will not lead to new features (abrupt edges, berms, jutting shoreline features) on the bottom or along the riverbank that could substantially alter river flows such that unacceptable surface elevation rises are caused locally or otherwise. This can be accomplished through appropriate hydrodynamic modeling if such features are present in the design.	Demonstrate that cap will not cause an unacceptable flood rise in conjunction with the overall remedy for that area. This can be accomplished through balance cut and fill calculations or appropriate hydrodynamic modeling that considers capping and dredging in adjacent or nearby areas.	
Containment	Although dredge residual covers are not intended to “contain” residual contamination, demonstrate that any such covers necessary will be present and available for natural intermixing with surface sediments over a reasonable time period (i.e., covers will not be quickly eroded downstream under typical flow conditions).	Demonstrate through cap modeling consistent with guidance that the cap design is sufficient to contain and minimize flux of contaminants over a design life consistent with guidance. This would include incorporation of “active” cap features such as organoclay and activated carbon as indicated necessary by modeling runs. The modeling would consider not only the contaminated sediment properties and concentrations but also the presence of any ongoing, stranded, or uncontrolled upland groundwater plumes. The cap design and modeling runs should appropriately incorporate the in-river conditions (good or bad) created by any ongoing or planned upland groundwater source controls.	
DOCR	Demonstrate that the DOCR can be effectively removed by the dredging equipment proposed while providing stable side slopes. If the DOCR can not be completely removed, demonstrate that any remaining contaminated material can be effectively capped by meeting all of the capping criteria as applied to the new depth horizon created by the proposed dredging.	Any DOCR can be capped as long as the other criteria are met.	
NOTES		6) Both capping and dredging can be engineered outside the vast majority of areas outside navigation and FMD areas and away from structures. All of the other issues often discussed do not completely rule out the effective design of either capping, dredging, or dredge/cap combination remedies. The most effective of these designs should be determined in RD based on site-specific engineering evaluations and any new RD data collected to support such evaluations. These other issues include: debris; flood concerns; slopes; wave, current, and propwash erosion; sediment bed geotechnical stability, depositional areas, shallow areas, and habitat concerns.	
1) Removal of very deep contamination may cause unstable side slopes, threaten nearby structures, or other issues. EPA used an FS-level assumption that >15 ft DOI was infeasible to remove. In RD a site specific engineering evaluation would be conducted to determine the feasible depths of removal for any given situation.		7) The purpose of decision criteria is to determine whether there are any fatal flaws to either a dredging or capping (or dredge/cap combination) remediation approach and verify that the technology would be both effective and protective (including meeting ARARs). Decision criteria do not determine the relative cost effectiveness of the technologies. If both technologies are demonstrated to be effective, and capping is feasible considering factors such as current or proposed future site uses, habitat impacts, flood impacts, short term impacts, business concerns, or logistical issues, the most cost effective remedy will be selected.	
2) Is contamination deeper than needed or required navigation depth plus needed cap depth and any cap and navigation safety factors?		8) The term capping may also include other types of in-situ remediation (e.g., in-situ treatment and thin layer capping). If these other types of in-situ remediation appear preliminarily feasible, the capping demonstration criteria should be generally used but may need to be modified in some cases, particularly the containment criterion.	
3) Where dredging is the selected technology, site specific engineering calculations would be conducted in RD to estimate the range of dredge residual concentrations likely in various dredge management areas. Dredge residuals management procedures such as sand covers will be determined in design based on the estimated concentrations of residuals relative to the RALs and may include addition of activated carbon to sand covers if dredge residual concentrations are expected to be relatively high.			
4) An RD engineering evaluation would be conducted to determine the cost effectiveness of dredging vs. possible dredge and cap back options.			
5) The “permanence” of a structure would be determined in RD based on existing and planned future uses for such structures including potential plans for refurbishing or improving the structure to maintain existing uses or expand to additional new uses (i.e., this evaluation is not based on the perceived or actual current structural or physical integrity of the structure).			